Reinventing Paris

A new Neighbourhood
Obtaining and Creating energies

A thesis promoting and exploring architectural-tectonic design in and of the city

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Abstract

This Thesis project presents an architectural-tectonic design proposal for the unexploited site of ***Place Mazas Square, 12th arrondissement, Paris***. The New Place Mazas Square is the result of a project that aims to explore and investigate how to boost social sustainability and promote the resilience of the urban structure in a metropolis undergoing an ecological transition adaptable for the changes of the future. This by exploring a multiscale working method to fuse inherent site-specific potentials and to ensure a respectful approach towards the surrounding contextual conditions. The project is based on a desire to exploit existing energies of Paris to enhance new ecologies and synergies between functions and users. This resulted in the creation of a ***Neighbourhood Hub*** with habitation and shared functions, a ***Food Hub*** with a Bouillon restaurant and a greenhouse in great connection to an urban farm. This to enhance the community and create diversity through architecture programming that enables opportunities to attract awareness and change habits towards a better future. The New Place Mazas becomes a square with a strong collective identity to promote new modes of living, being and inhabit the city. A strong architectural-tectonic approach have been consistent through an integrated design process. Design solutions have been developed and evaluated due to functional, technical and aesthetical aspects in order to create a design with a solid architectural and tectonic intention, which in tandem enhance each other and create more than the sum of the parts.

“Because we don’t have a choice
We need to demand a livable planet
And we don’t trust anyone who says
It’s too late to fix the climate crisis
Because the reality is
We can imagine a healthy future
So don’t tell us that
We’re all screwed”

(Read this part bottom up)
– Patagonia (2020)

“It has become a matter of politics.
But a green solution affects all of us
Not least our children, grandchildren and descendants
It has become so topical now that it is a supernatural issue.”
– (Kronprins Frederik, 2021) Own translation

"Right here, right now is where we draw the line.
The world is waking up.
And change is coming whether you like it or not."

– Greta Thunberg (2019)

Motivational introduction

The New Place Mazas Square is a thesis in Architecture and Design Engineering exploring the conceptualization and physical tapestry of historical, cultural, and societal development in the abstract logic of time. The thesis aims to be a discussion through design. This by being an experimental journey existing in the cross field between abstraction of the future in a combination with examples of the concrete contemporary world. It is based on three students' desire to create architecture, space and atmospheres both suitable in current times of radical shifts as well as suitable to a sometimes unimaginable future. Since the ecological and biodiversity crises are inevitable, ecocentric thinking and understanding of environmental and social systems being entwined, interrelated and interdependent will be the crux of the matter for all processes.

Inspired by Le Corbusier's visionary thoughts and manifest-like approach (Corbusier, 1996) it is believed that architecture and engineering have the power to be a visionary groundbreaking catalyst concretizing current challenges by the capability of attracting energies and skills. Current political discourses with massive investments in climate mitigation measures not seen before and the global event of the Olympics 2024 in Paris become motivational energies for the thesis. It is the desire to transform and exploit the opportunities of these agendas, policy statements and events into a realistic architectural design proposal. ***The main objective of the thesis will be the development of a visionary design project for a new multifunctional Neighbourhood Square accommodating new modes of living, working and being in the heart of the city.***

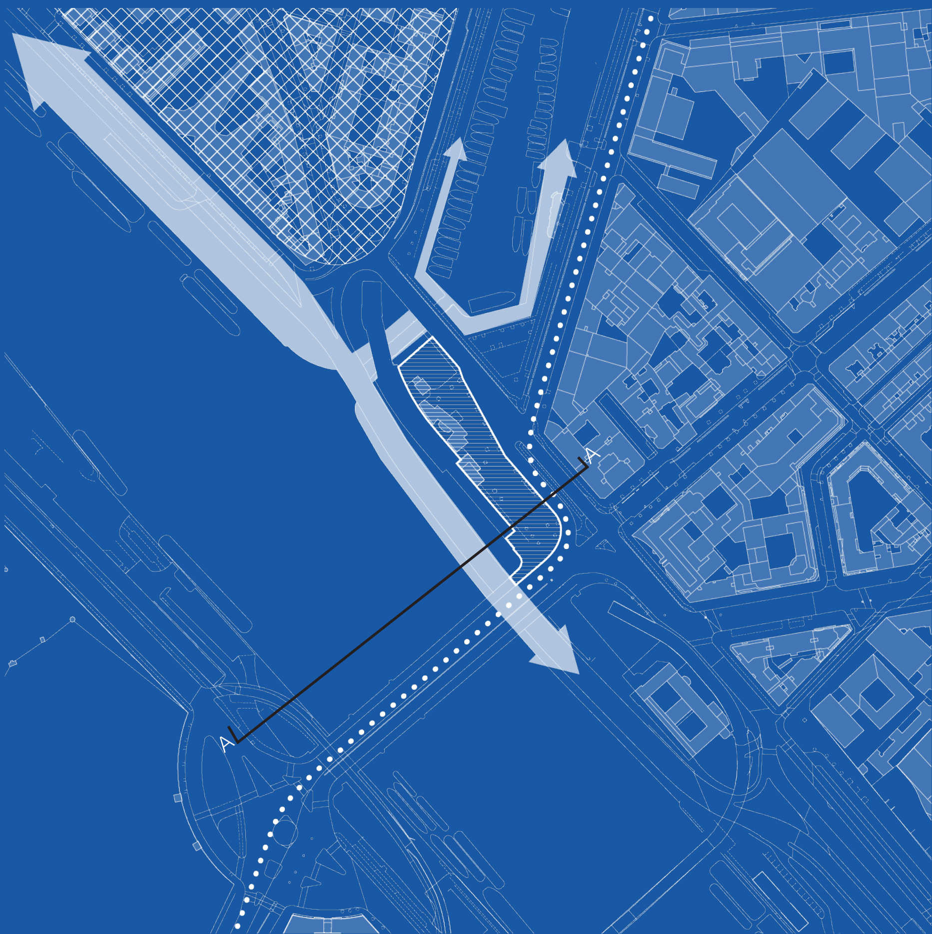
To be able to comprehend both current times and the future, the project will take inspiration from three *time scenarios*; 2024, 2030 and 2050. The 2024-scenario exploits the energies of the global event of the Olympics 2024 in Paris and is chosen to highlight the city's general ambitions and values. The 2030 and 2050-scenario are selected inspired by the Paris Climate Action plan's defining *'Action for 2030 & Ambitions for 2050'* (City of Paris, 2018). The 2030 scenario will be the fixed pivot, whereas scenarios 2024 and 2050 will function as implicit quality assurance of actuality for a design proposal suitable in respectively, current times of radical shifts and a sometimes unimaginable future.

"We must also meet the ***challenge of the urbanism of the future*** *in order to* ***adapt*** *to the city's changing boundaries. We need to become bolder and more* ***inventive****, and make the rules governing urbanism more* ***flexible****.*

Teleworking, co-working and shared services are all new modes of living *that should be taken into account."*

– Anne Hidalgo, Mayor of Paris, (Hidalgo, no date)

1. 2030 action plan, 1:100000



2. Zoom of site, 1:10000

3. Urban section AA, 1:5000

A New Paris

[Political] Action plan for 2030 & ambitions for 2050

The vision of the future Paris consists of comprehensive agendas, strategies and initiatives that reveal a metropolitan project based on the convergence of intense political energies and ambitions (L'Institut Paris Region, 2019). As in several other Western countries, France, including Paris in particular, has witnessed major political upheavals in recent years. In the 2017 election, Paris was dominated by En Marche, the party of President Emmanuel Macron, who with great green ambitions and goals has pushed Paris's incumbent socialist mayor Anne Hidalgo to political concessions, and who has since invested massively in climate mitigation measures based on "Paris Respire", a carfree scheme (City of Paris, 2022).

This thesis desires to entangle itself in the illustrated political tug-of-war towards the most ambitious green and sustainable agenda as an opportunity to make a real and relevant project proposal. All the following developments and initiatives only exist because of the political situation (agendas), hence this project is only possible because of this 'green' shift at the political level, which must also reflect the citizens of Paris.

As part of the international organisation C40 (C40 Reinventing Paris, no date) and initiatives like 'Reinvent Paris' and 'Paris Respire' the city of Paris has high ambitions for the future. The goal is a renewable and energy-efficient city combined with innovative policies that tackle social exclusion and enforce inclusive growth (OECD- Ford Foundation, no date; Hidalgo, no date). The *urban challenge* is to create a resilient city that is both inclusive and sustainable by addressing inequality and climate change in tandem (Hidalgo, no date).

Transformation of urban mobility has throughout history been a matter of huge changes as it is seen with the work of Georges Eugène Haussmann (1809-1891) and is again on the political agenda, as the transport sector is one of the most important environmental and societal challenges (City of Paris, 2018, p. 9). The Place Mazas square becomes a unique logistic urban structure with the potential to be reinvented as it is surrounded by ambitious infrastructural transformations; *Parc De River Seine, PER Velo(bicycle path) and a Traffic-ban* (Illu. 2).

Conceptually Paris can be thought of as a courtyard constrained radially with only hard infrastructure bridging the outside world with the inside world (Illu. 1). The Place Mazas Square has to some degree the same characteristics. The new infrastructural developments change this drastically on both scales. These new plans will manifest the *2030-scenario* and be the foundation of the urban scale strategy of the site, hence the framing conditions for the building scale developments on Place Mazas Square.

4. View towards site from Bd Bourdon

Energies of the Olympics & the River Seine

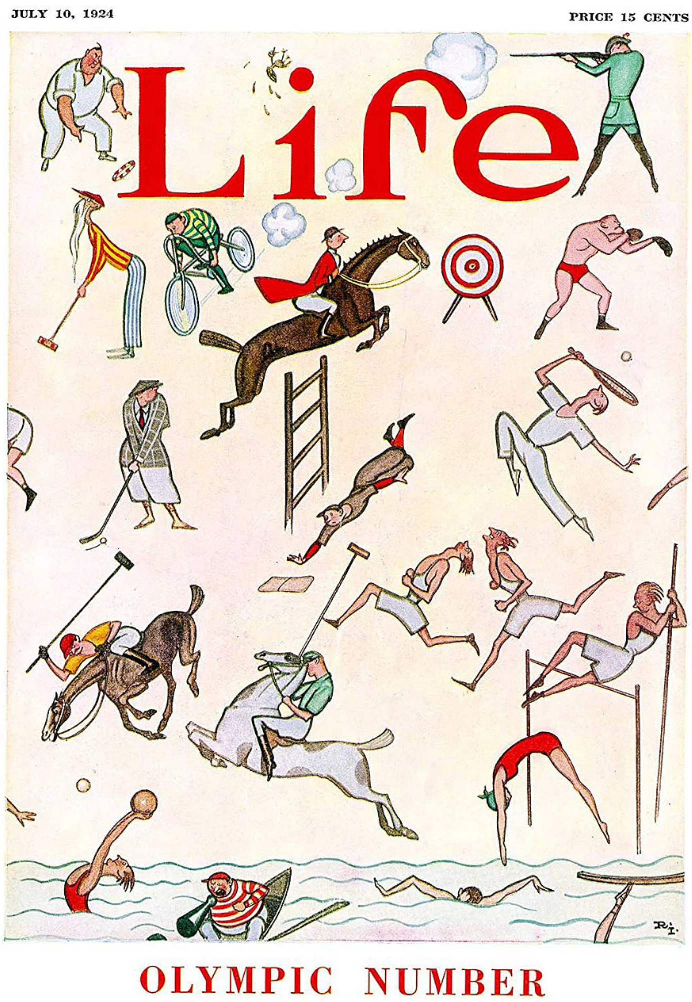
The *2024-scenario*, the Olympics 2024 in Paris, presents important core values of goals and affairs in which Paris is currently managed. The event is unfolded to work as motivation and foster inspiration and design thinking in an early stage of the process.

The Olympics have an old and rich history and great importance in linking sport, culture and social aspects, originating in ancient Greece, conducting the first modern Olympics in 1896 in Athens (History.com, 2010). For the third time, Paris will be hosting the Olympic games in the summer of 2024, the first time being 1900 and the second in 1924. As the city of Paris has high ambitions for future developments, so has the Olympics 2024 with the statement; *"First sustainable, inclusive and supportive Games in history!"* (ESS2024, no date). With the summer Olympics 2024, Paris has a vision of creating a more sustainable event, offering one of the world's most inspiring cities as a memorable and grand stage for the athletes. The vision is to activate the whole city and utilise 95% of existing temporary venues for the Games, with the promise that every venue has a clearly defined legacy aligned with the city's long-term development plans.

The river Seine, creating the central vein of Paris, will set the scene for the opening ceremony with 160 boats carrying the athletes departing from the *Pont d'Austerlitz*, right in front of Place Mazas Square, to *Pont d'iena* (Paris 2024, no date, a) this making the opening ceremony an event for the entire city to witness (Paris 2024, no date, b). This could be the culmination of many years' work of giving back the river Seine and its banks, reinvented as Parc De River Seine, to the citizens for relaxation and leisure. As the quote indicates it is a matter of increasing the citizens' attachment; *"A new page in the history of this exceptional site is to be written from today, by all of you..."* (City of Paris, No date b).

"We will offer one of the world's most inspirational cities as a memorable stage for the athletes – and a truly global platform to promote them, and their incredible stories." (Paris 2024, no date, b)

Ambitious visions must be followed by concretizing practices. Primarily at an urban strategic level it is desired to use Paris' vision to create a new Olympics (2024-scenario) with the city as the main stage as a vector for the promotion and adoption of new habits and uses (2030-2050-scenario). To exploit the possibility of seizing one catalyst (2024-scenario) to create another (2030-scenario).



5.

Glimpse of Paris

Seen through a non-chronological set of historical, cultural and architectural events.

Today it is hard to believe that the practicalities of the ability to build a bridge long enough are one of the reasons for the development of the city of Paris (Hvidt, 2004). The history of Paris, the magnificent culture and its people is hard to comprehend. The following are a glimpse of relevant and inspiring topics, which are to be elaborated in the later paragraphs.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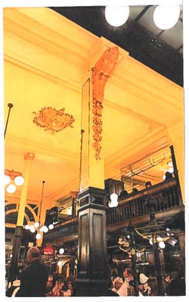
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The Seine and its banks

Let's start with the Seine and its banks. Paris was built from the Seine and for more than 2000 years, its banks have been places to live and thrive. The river has been a vital axis through time. From *trade & transport* nerve in antiquity to the 17th century, *leisure & entertainment* such as public baths through the 18th and 19th century escalated in the 20th century as a thriving urban place to attract unusual activities and enriching events. The development of the canals, Arsenal basin, is gradually revitalising the Seine, as industrial activities are gradually shifting to the north of the capital, only to boost the leisure activities. Right until the colonisation of the banks by the cars with express-roads along the river (City of Paris, No date b).

Food, health and rebellion

In the 1840's *"Vivre, c'est ne pas mourir" - To live is not to die,* flourished among the poor under the tough living conditions, in which the price for bread became absolutely decisive. If a certain price limit were exceeded (two sous), almost as it was automatically programmed, a 'hunger revolt' exclaimed (Hvidt, 2004). In 1855 the first Bouillons appeared with the concept of serving good quality and healthy food at an affordable price (Bouillon Racine, no date). A concept which has significant similarities to the city's current goals concerning food


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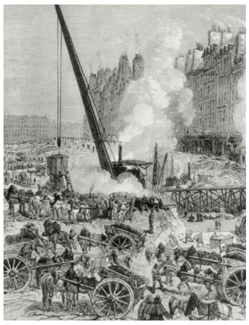
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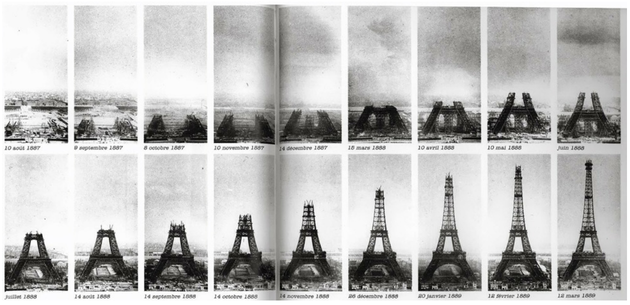
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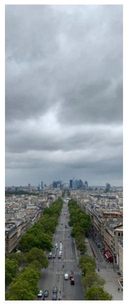
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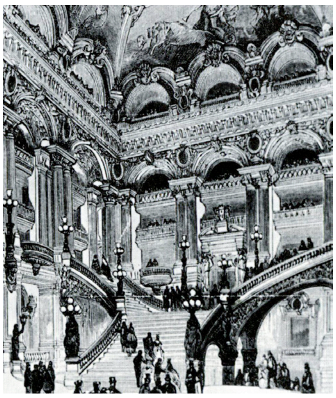
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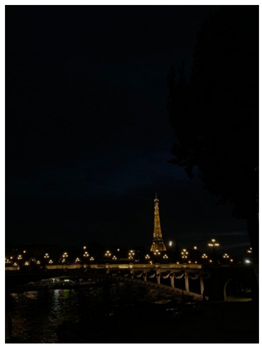


6. Glimpse of Paris through time

(City of Paris, 2018) to prevent, among others, the appearance of 'plastic sandwiches' in the disks observed on a study trip to Paris.
Les Halles, an immense food market, is related to both Haussmann's extensive developments, progressive architects, new technology with cast iron and glass structures and Paris's marvellous cuisine. Only to be demolished in favour of the Pompidou Centre and a huge underground department store (Hvidt, 2004).

Napoléon & Haussmann
Napoléons goal was to transform the old Paris into a glorious imperial metropolis. This, the greatest urban redevelopment of world history, took the two decades Napoléon ruled Paris. The unhealthy mediaeval large city was through this time sanitised and sectionalized by 90 km of new streets and boulevards cornered by trees and modern residential areas (Hvidt, 2004). The transformation supported the military control of the citizens, while it established the foundation for the development of an iconic 'boulevard culture' of strolls and flourishing cafes along the promenades (Gehl, 2010). *In a brief, it is the evolution of the Parisian townscape we know today.*

Design challenges

The following three pillars; *Challenge, Opportunity* and *Platform* are the foundation of the three major *Design Layers* of the project. The statements become guidelines for the substance of the project, which will end up defining three design layers; an *Urban*, an *Architectural* and a *Technical & Structural* Design Layer. The Design Layers are strongly entwined, as the Urban design layer sets the potential for the Architectural and Technical & Structural design layer, however, these are the objective of this project. The urban layer will be developed on a conceptual strategic level.

Challenge
Paris is a global metropolis in the middle of an ecological transition to transform and adapt itself to address the major environmental and social challenges of the 21st century (City of Paris, 2018). The challenge for Paris is to simultaneously make major urban transformations [**Urban challenge**] and to become an easier place to inhabit, more socially responsible and more energy-efficient in times of new modes of living [**Architectural challenge**] (OECD - Ford Foundation, no date; Hidalgo, no date). In continuation the energy efficiency requirements are challenging the architectural qualities (Andersen, 2019), hence Paris is now facing a challenge in maintaining its iconic architectural expression and simultaneously fulfilling energy requirements [**Technical & Structural challenge**].

Opportunity
Political agendas which are boosting urban developments and major global events such as the Olympics 2024 are seen as generators that the project has the potential to seize as energies in the transformation of Place Mazas to become a local catalyst itself [**Urban opportunity**]. These found an opportunity to develop and give concrete expression to contemporary ambitious polial declarations of intent to promote and ensure the ecological transition while enforcing the local community [**Architectural opportunity**]. The city of Paris is additionally granting an *"experimentation permit"* in the pursuit of an integrated sustainable design solution (City of Paris, 2018, p. 37). This prepares the ground for an experimental tectonic approach to develop a design solution suitable for new modes of living and adaptable for rapidly changing lifestyles [**Technical & Structural opportunity**].

Platform
The consequences of centuries of fragmentary urban developments have left the Place Mazas square as an unexploited urban structure encircled by heavy infrastructure in an urban cross-field between the old city centre, the river Seinen and the Bassin de l'arsenal [**Urban platform**]. Generated by mentioned opportunities the Place Mazas square has the potential to tell a new story resting upon the city's history, the building tradition of Paris with historic and beautiful structures that has been standing for many years [**Architectural platform, Technical & Structural opportunity**]. This creates a foundation to inhabit and develop this heritage and exploit hidden potentials.

	Challenge	Opportunity	Platform
Urban	Major urban developments to **adapt to the climate changes**	Exploit **political agendas**	Place Mazas; an **unexploited** urban structure ready **to be defined**
Arch	**Adapt to New Modes of Living**; shared functions & multi-purpose restriction	Exploit **energies** in the near context	Place Mazas; a unique square with **hidden potentials ready to be articulated**
Tech	Architectural heritage and **iconic expression vs. energy requirements**	Exploit **'experimental permit'**	Place Mazas; a sqaure suitable to **fuse traditions and new building practise**

A matrix to generate critical questions and design thinking about what the architecture of the future is, and how to develop it.

How can architecture, taking a multidisciplinary and multiscale approach, be used to initiate action to boost social sustainability and resilient urban transitions in the square of Place Mazas? This by using critical design thinking on contemporary sustainable building practice, to promote a new ecological understanding of tectonics.

Initial problem statement

The following sub-questions are divided into three overall theoretical questions, which links to the three Design layers as;
ACT corresponds to the Urban layer,
LIVE to the Architectural layer,
BUILD to the Technical & Structural layer.

How Will We ACT Together?
How can architecture exploit political agendas, major urban developments and global events to initiate action in the local community?
How can architecture by concretising future ambitions be used to comment upon contemporary social and environmental challenges in the complex systems of Paris? Hence how can architecture boost social sustainability simultaneously with creating resilient urban transitions?
This by revealing inherent contextual potentials in an ambitious architectural project that speaks the language of a better future.

How Will We LIVE Together?
How do we create an architectural typology that accommodates new modes of living, that exploits the existing connections of the city to create and enhance local communities and by that enforce the connectedness?
How do we create a multi-house for the community with synergies between users, functions and the city, that actively can educate and embrace awareness of a changing world?
A house which becomes a common flux able to produce more than the sum of its parts. A house that illustrates new solutions of living while being an inclusive platform for these to be visible and inspirational as a way to *boost social sustainability*. Providing a piece of architecture resilient enough to adapt to changing contextual conditions, while over time becomes a catalyst that can re-shape those conditions.

How Will We BUILD Together?
How can we, in contemporary society, regenerate the connection between the architectural and structural layer using a new ecological understanding of tectonics?
How can an ecological understanding of tectonics create architecture that does not give up on human well being and neither on architectural craft and aesthetics?
An architecture that does not exist as a physical object, but as an element in the complex web of the city.

Methodology

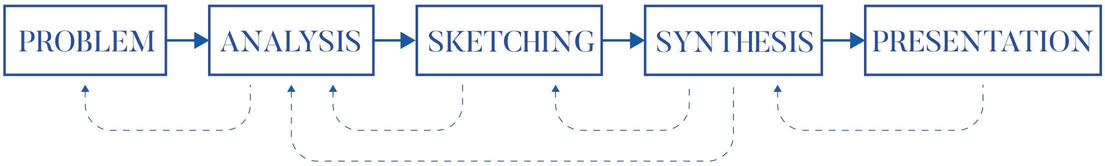
The challenge of addressing and creating an ambitious, aesthetic, and ecological design proposal for a mixed-use typology on a complex, fragmented urban wasteland in Paris claims the need for a balanced and diverse methodology and architectural approach. An approach that grasps the complexity of designing a structure in contemporary society that will also function in an ever-changing world with high demands for sustainable innovative thinking, thus making it a building that will form the understanding of the site and be a place for people to gather and live for many years to come. To do so the project has introduced the inspirational scenarios previously described as an implicit design tool to ensure a sustained awareness of actuality through a complex process. Additionally, the three presented *Design Layers (Urban, Architectural and Technical & Structural, p. 19)* function as active design tools and methods in the process of a building that will utilise energies created by a metropolitan city like Paris simultaneously with having the resilience to handle future global demands caused by a changing climate and new modes of living.

To address and scrutinise subjects such as ecological tectonics, ecology of cities and mixed-use typologies requires an interdisciplinary and holistic integrated design process in the frame of an ecocentric approach. The ecocentric approach is seen as the framework, in which the project emerges enabling social and ecological systems to maintain a healthy state and to evolve. This is the thinking behind a regenerative design approach, with the core principle 'From less bad to more good', which must be holistic and focus on the long-term perspective with the awareness that humans and the built environment exist together with natural systems, hence an ecocentric worldview (Naboni and Havinga 2019).

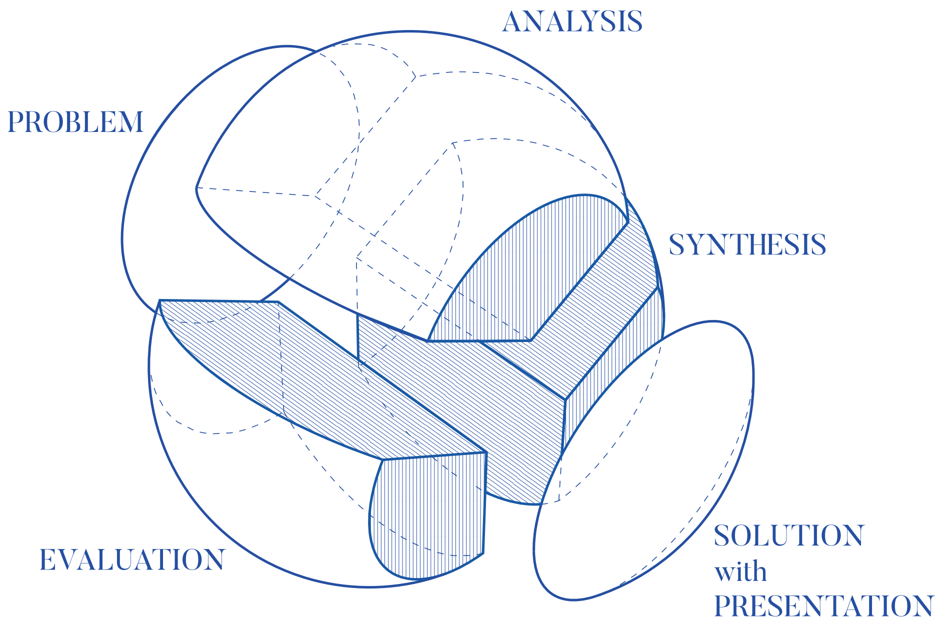
Through prior projects it is experienced that an overall integrated design process successfully fuses together the fields of architecture and engineering and embraces other sciences in the field of sociology, psychology, history, art and more, which are all seen of equal importance in a project of this character. To create architecture for and of the city, one must grasp the essence of crucial surrounding conditions in the city. Creating a building on a complex site for an ever changing society requires a thorough understanding and manifold approach to used methods.

Throughout the project an integrated design process is used, mainly inspired by Bryan Lawson (Lawson, 1997) and Mary-Ann Knudstrup (Knudstrup, 2004).

The integrated design process, IDP (Knudstrup, 2004), is one of many maps (Illu. 7) created a creative design process, however, in this instance the use of engineering aspects in collaboration with the creation of architectural design seems unique. The method divides the process into five different stages; ***problem, analysis, sketching, synthesis and presentation***. Although the process is described as iterative, where different loops must be implemented between the phases, it is visualised and portrayed as a sequence of activities, which in practice is rather unconvincing. The idea that the activities of the method occur in a certain order, or even that they are identifiable separate events is questionable. It seems that a more accurate portrayal of a map of the design process is shown by Bryan Lawson (Illu. 8), however, like any other diagram, it is rather simplified, while the actual course of action is a highly complex mental process. Lawson describes the design process as a negotiation between problem and solution with each seen as a reflection of one another. The process is seen as a map with no indication of a starting and finishing point, here referred to as ***problem, analysis, synthesis, evaluation*** and ***solution***, but with no indication of direction of flow from one activity to the other (Lawson 1997, p. 47). The project makes use of a collaboration between the phases described by Knudstrup and Lawson (Illu. 7-8).



7. The Integrated Design Process (IDP)



8. The Design Process seen as a negotiation

For the project to be sufficient and seek towards a common result, a problem is established. Through empirical studies of societal and environmental challenges, and visions for the future defined by the city of Paris, a common problem and focus is defined by a three-part *Design Layers* emphasising the *challenge, opportunity* and *platform* of the project (see p. 19). However the problem is not conclusively defined in the beginning of the project while we learn about the problem through attempts to create solutions rather than through deliberate and separate studies of the problem itself (Lawson, 1997, p. 43).

The **analyses** are carried out and targeted, producing a solid foundation on which the design phase can rely. This analysis phase consists of two major *sub-approaches* both using an overall methodology consisting of a mixed-method approach. The *theoretical considerations* (Chapter II, III and IV) are mainly based on deductive reasoning and investigation to foster common understanding of relevant subjects and thematics, highlighting the actuality, potentials and challenges of the project. This becomes a theoretical framework in which an *analytical* sub-phase (Chapter V and VI) takes place mainly based on inductive investigations. Together they form the framework of the project. To increase the understanding of both the theoretical considerations along with the general reading of the site, it is desired to use different analytical and critical methods such as *case studies/referential drawings, sketching, literature studies, cartographical studies* along with field study *observations* and *registrations* using a phenomenological approach. Throughout this process of precedents, it is desired to be able to draw logic, create design strategies and principles and to generate creativity and critical thinking (Unwin, 2014).

The **synthesis** is characterised by an attempt to move forward from the analyses and create a response to the problem. This is done by the generation of solutions (Lawson, 1997, p. 35). It is not possible to grasp onto solving the problem all in one, whereas smaller parts and pieces of the design must be solved separately and later together as a whole.

The suggested solutions are **evaluated** against the objectives identified in the analyses phase (Lawson, 1997, p. 36). The evaluation is a counterbalance between various parameters to ensure the quality of the design. In this phase it is also seen as an important part to implement a sub-phase; **decision**. Decisions however vague or well argued must be taken to encourage the process.

In The Integrated Design Process by Knudstrup, a phase of **sketching** is found between analyses and synthesis. However, in this project *sketching* as a tool is rather seen as an inevitable and indivisible part of both the analyses, synthesis and evaluation. Using different tools such as *digital sketching, hand sketching, writing, painting, modelling, technical sketching, calculations* generate ideas and designs as parts of the analysis, synthesis and evaluation.

The **solution** becomes the result of the design iterations. As the problem, defined in the beginning of the project, may be redefined during the process, so will the solution.

The final solution obtained by the many loops between the different phases is presented in the **presentation**. The great importance of this phase lies within facilitating the design. If the essence and the importance of the project is not presented here, the essence of the preceding work is lost.

"... there is no natural end to the design process. There is no way of deciding beyond doubt when a design problem has been solved."
– (Lawson, 1997, p. 53)

"...I believe that a good design process must probably be learned rather than thaught!"
– (Lawson, 1997 p. 306)

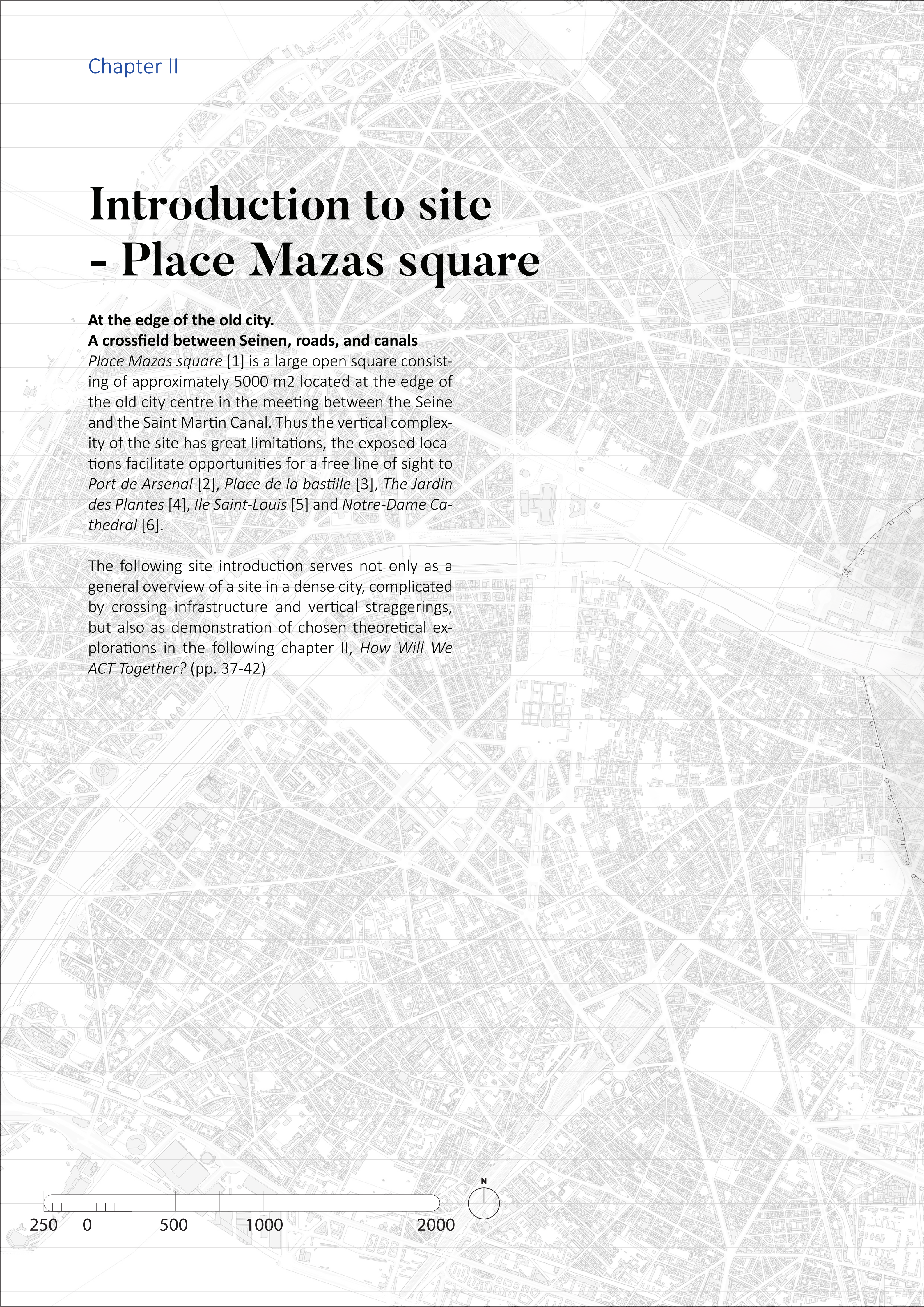
Chapter II

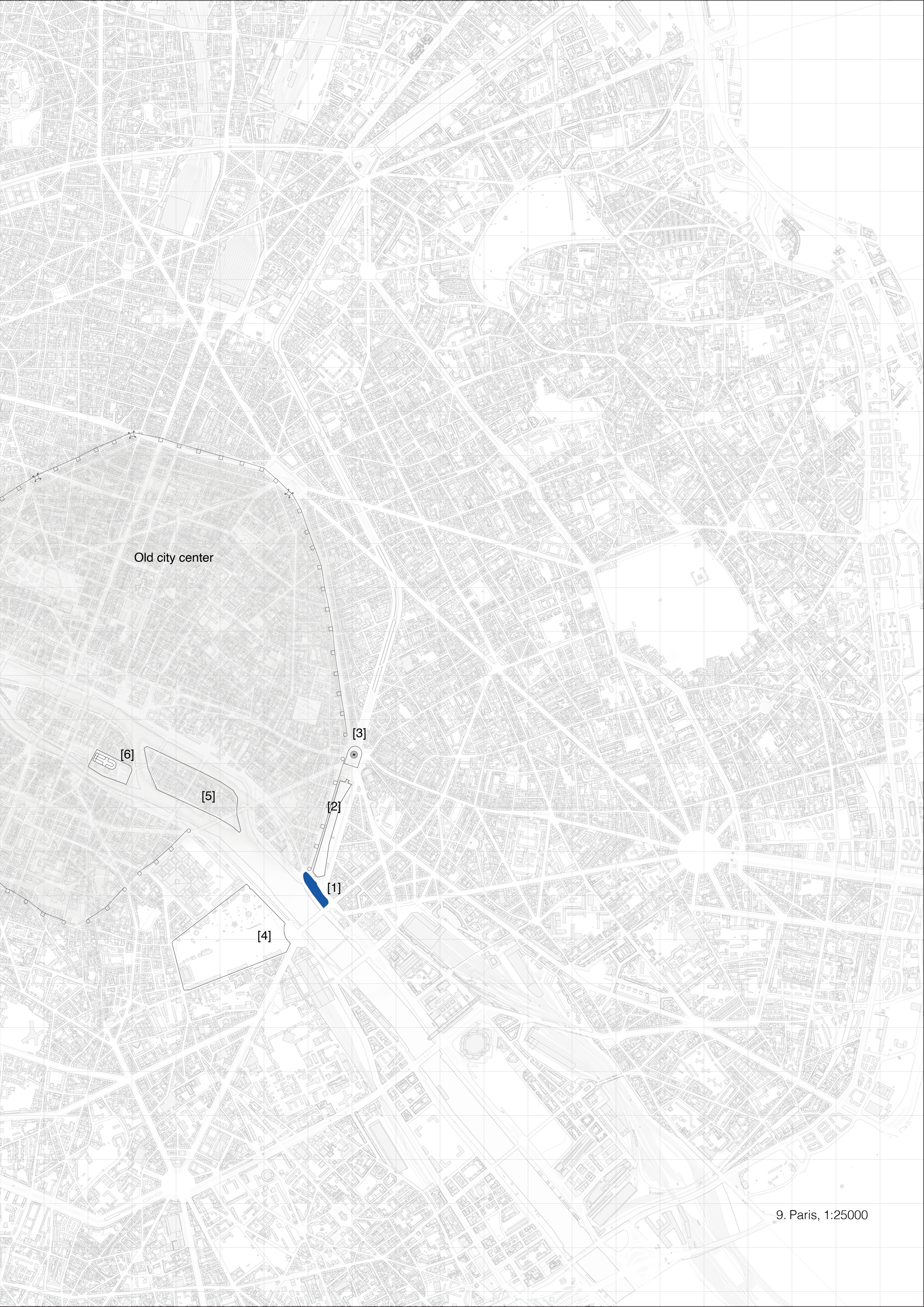
Introduction to site - Place Mazas square

At the edge of the old city.
A crossfield between Seinen, roads, and canals

Place Mazas square [1] is a large open square consisting of approximately 5000 m2 located at the edge of the old city centre in the meeting between the Seine and the Saint Martin Canal. Thus the vertical complexity of the site has great limitations, the exposed locations facilitate opportunities for a free line of sight to *Port de Arsenal* [2], *Place de la bastille* [3], *The Jardin des Plantes* [4], *Ile Saint-Louis* [5] and *Notre-Dame Cathedral* [6].

The following site introduction serves not only as a general overview of a site in a dense city, complicated by crossing infrastructure and vertical straggerings, but also as demonstration of chosen theoretical explorations in the following chapter II, *How Will We ACT Together?* (pp. 37-42)

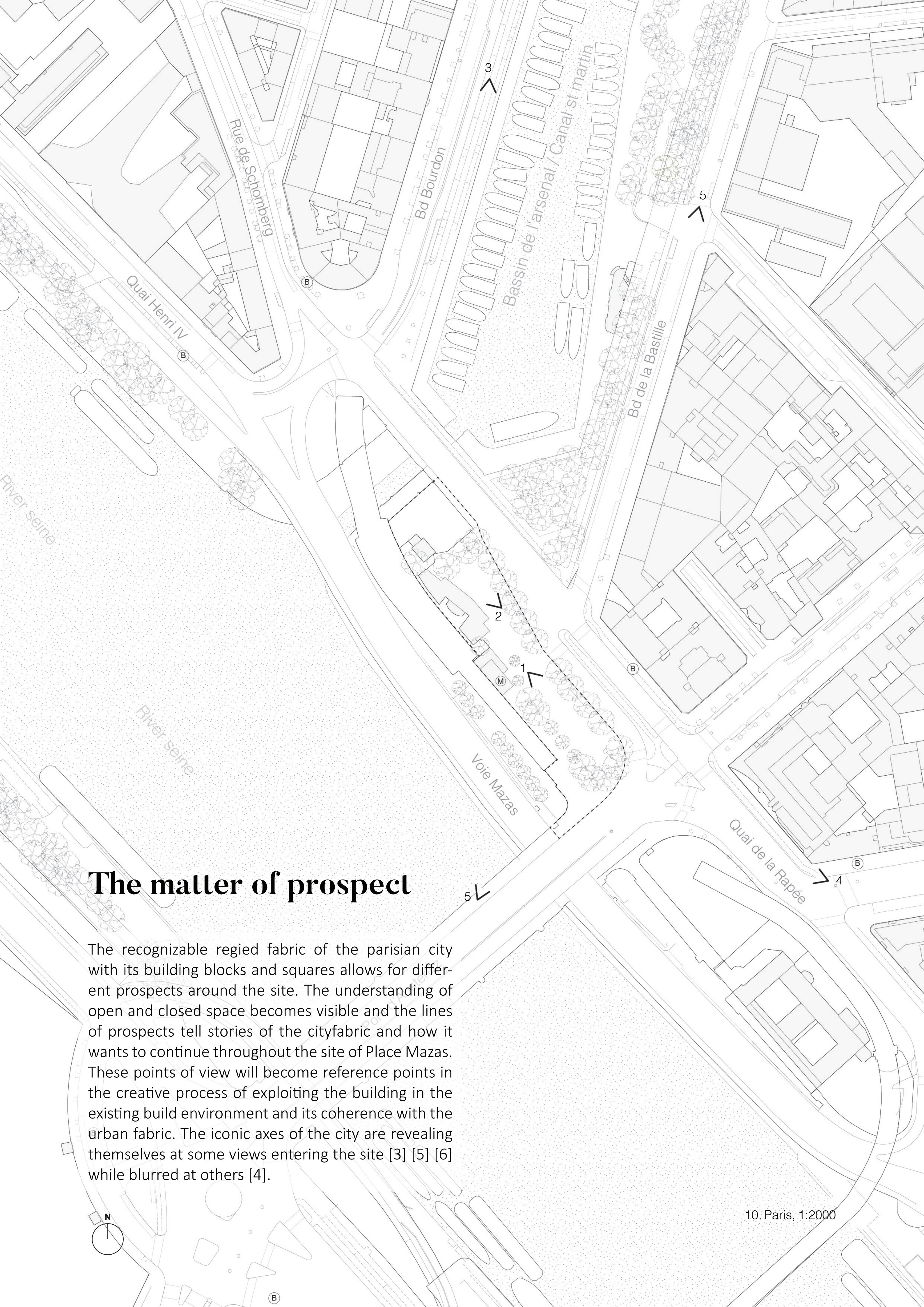




9. Paris, 1:25000

The matter of prospect

The recognizable regied fabric of the parisian city with its building blocks and squares allows for different prospects around the site. The understanding of open and closed space becomes visible and the lines of prospects tell stories of the cityfabric and how it wants to continue throughout the site of Place Mazas. These points of view will become reference points in the creative process of exploiting the building in the existing build environment and its coherence with the urban fabric. The iconic axes of the city are revealing themselves at some views entering the site [3] [5] [6] while blurred at others [4].



10. Paris, 1:2000


1. On site


2. On site

3. Bassin d'arsenal framing the site with a free horisont creating a blank space to build against.

4. The infrastructural chaos creates a barrier to the site, while a free horizon creates the background.

5. The strong axis of the road and the continuity of trees along it framing the site.

6.The river Seine and pont d'Austerlitz create a beautiful open setting with the iconic Haussmann architecture as the background.

11. Pictures of the site

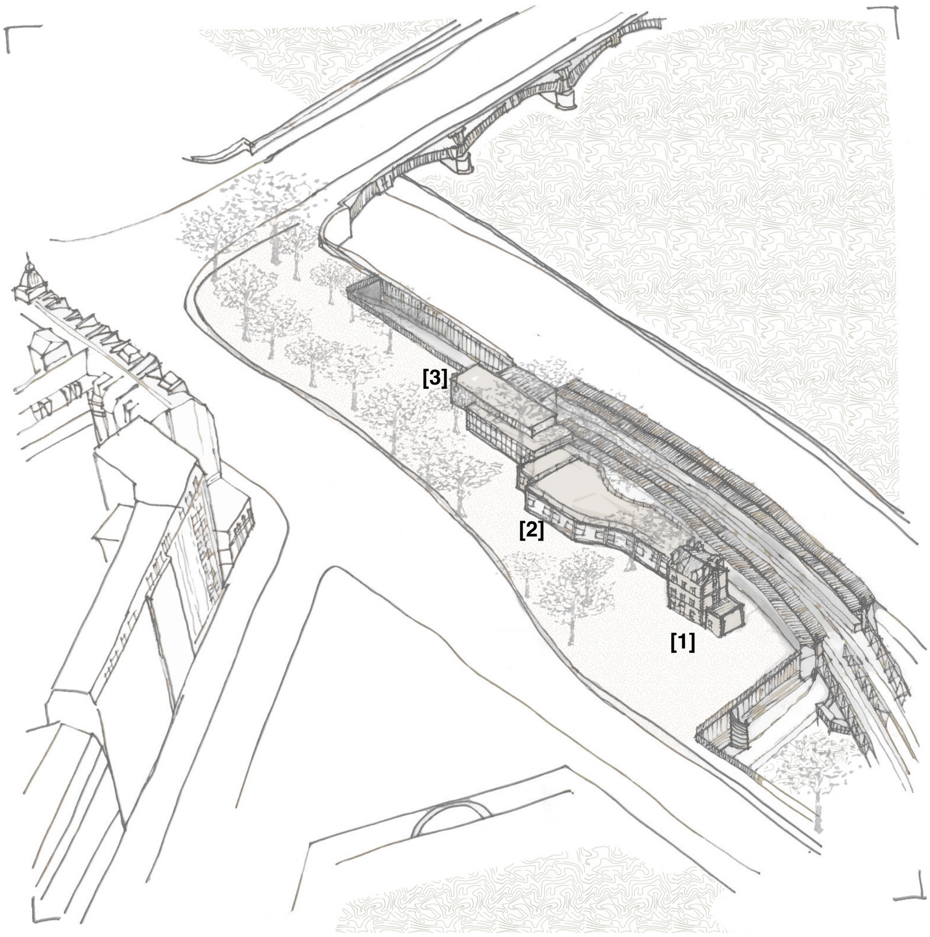
Place Mazas square encircled by roads

12. The site encircled by roads

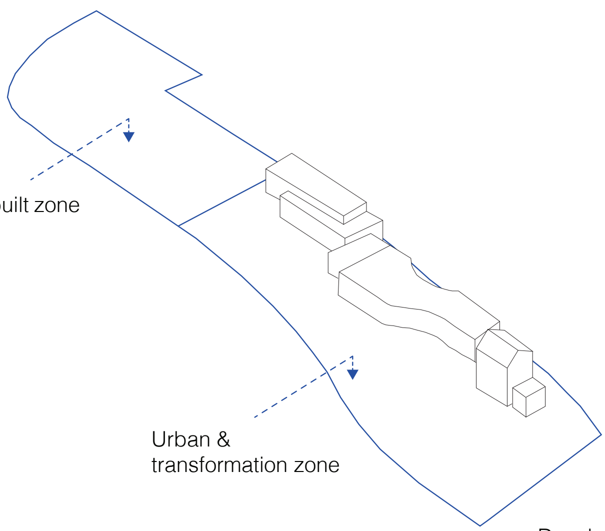
The distinctive features of Place Mazas are found in the fragmentation of structures- the absence of a cohesive square with identity. The site is currently surrounded by heavy infrastructure in the form of busy roads, the bridge; Pont d'Austerlitz, and a metro station. As several urban mobility developments are to promote soft traffic the potential for redefining the square increases.

The metro station on Place Mazas square

13. Metro station and rails on the site



Site sketch



Developments zones

14. Place Mazas / The site

Place Mazas overview

History and functions of Place Mazas
The fragmented characteristics emerge across the site by three building structures; *Lock keepers house* **[1]**, *Quai de la Rapée [metro station]* **[2]** and *a one story brick building* **[3]**. Additionally, the site consists of an open space encircled by 29 trees being the most coherent element on the site (City of Paris, no date a, p. 2). The structure is examined separately to be able to rumble the inherent qualities of the site.

The lock keepers house, 1905, approx. 128 m^2 [1]
The three story Lock Keepers House is currently run by a sanitation station of Paris. The building is classified as being in good condition and will be released from occupation in 2022. Underneath the house a sanitation station and wastewater plant is placed. Due to the permanent structures and installations in the basement the municipality of Paris requests that the area in front of Lock Keepers house will be used for urban recreative structures. The project will follow the mentioned request through developments of the urban concept, thus the Lock Keepers house will be up for transformation entangled in the architectural design process.

The brick building, 1988, approx. 322 m^2 [2]
The one story red brick building is public domain and is being released for all current occupations in 2022. Although the building structure is locked to its original shape, the project assesses that unconstrained creativity is important for the design process and concept development of the project.

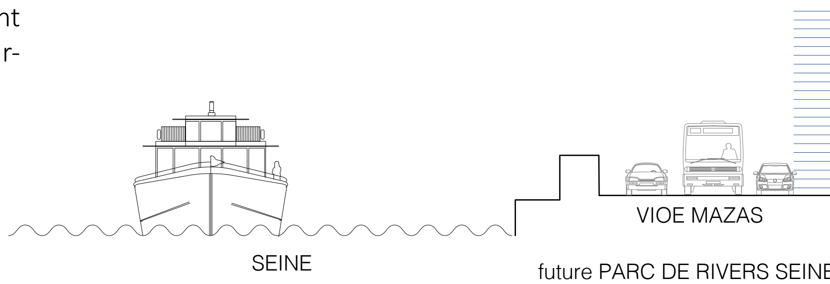
Quai de la Rapée Métro [3]
The metro station is the primary function contributing to the daily flow on the square. Its service ensures sustainable connections to the rest of the city, thus a degree of *connectedness* is ensured by its existence. This attractiveness and evidently opportunities emerged by the station's functionalities will be prioritised as an important asset of the future Place Mazas.

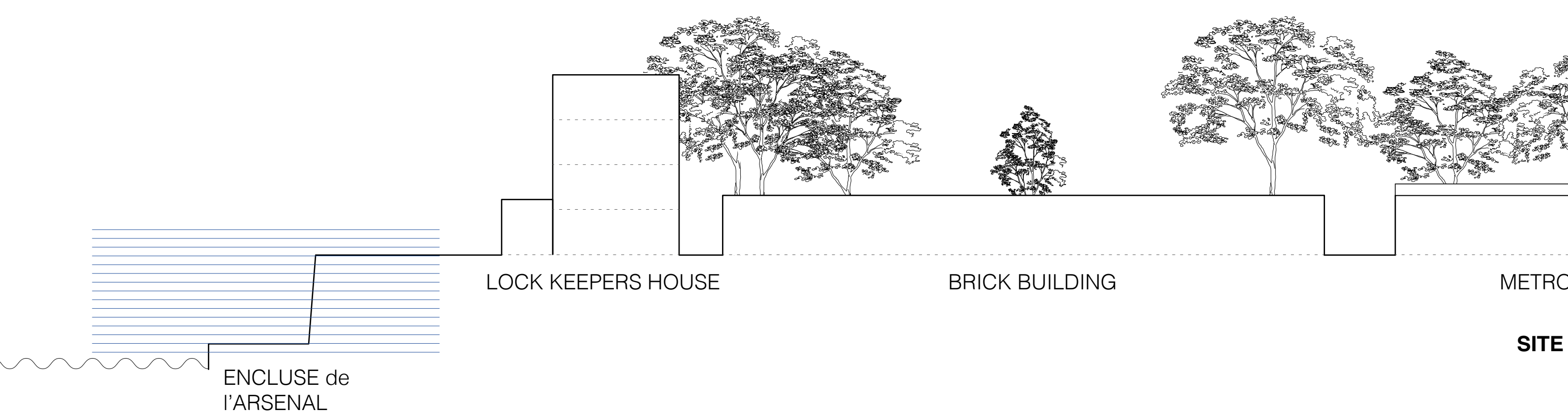
Sub-conclusion
Consequently, by relating the site to the regulatories and PLUs, Place Mazas can be divided into two intertwined zoons (Illu. 14); ***urban & transformation*** and ***new-built***. It is desired to preserve the 29 trees as green structures with inherent qualities obvius to exploit; noise barriers, passive solar shading and objects of power of cohesion.

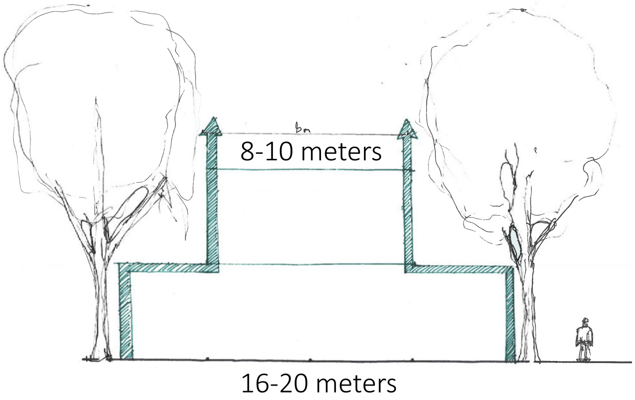
Missing urban links

The drawings embrace the extent to which the Place Mazas Square exists as an *urban gap* between different boundary structures. Functional disconnected from the Parisian urban landscape, thus the metro stations enhance great possibilities to enforce urban connections between the life on the streets and the underground web of range. The challenge to process the missing connections to ensure equal opportunities for conditions to re-shape over time is clear.

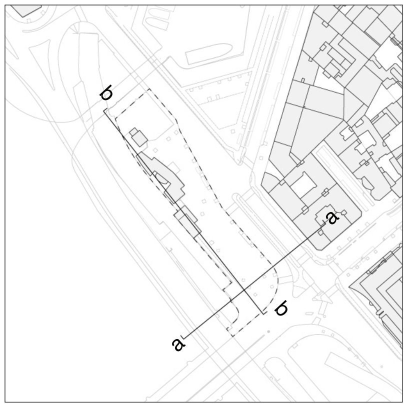
The sections reveal the great delimitations of both major urban infrastructure and green structures, with the infrastructure opposing a human scale; the green structures emphasise comfortable qualities relating to the human scale (Illu. 15). The phenomenological contrast in scale and appearance substantiates towards reinventing the program of the site. It should not be about destruction but restructure of inherent qualities that underlines and benefits from the characteristics as much as possible.

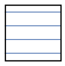




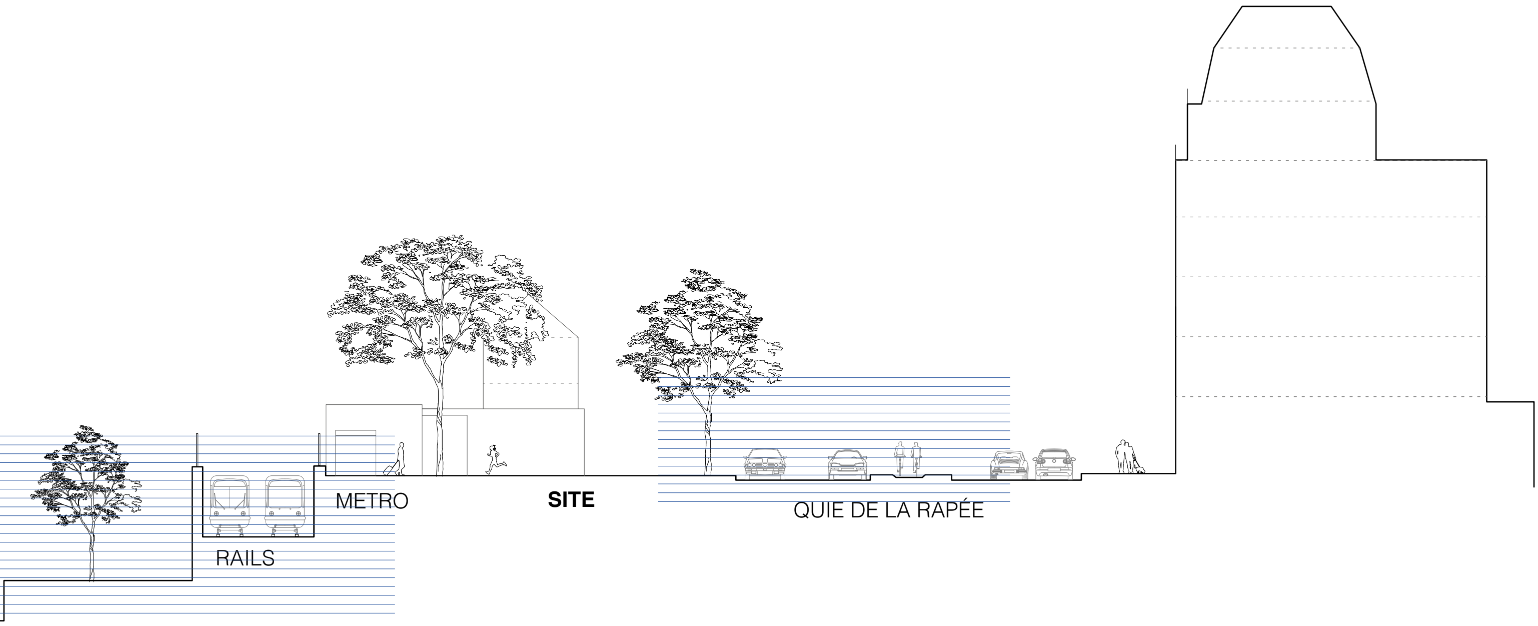


15. Boundaries created by existing trees





Missing connections



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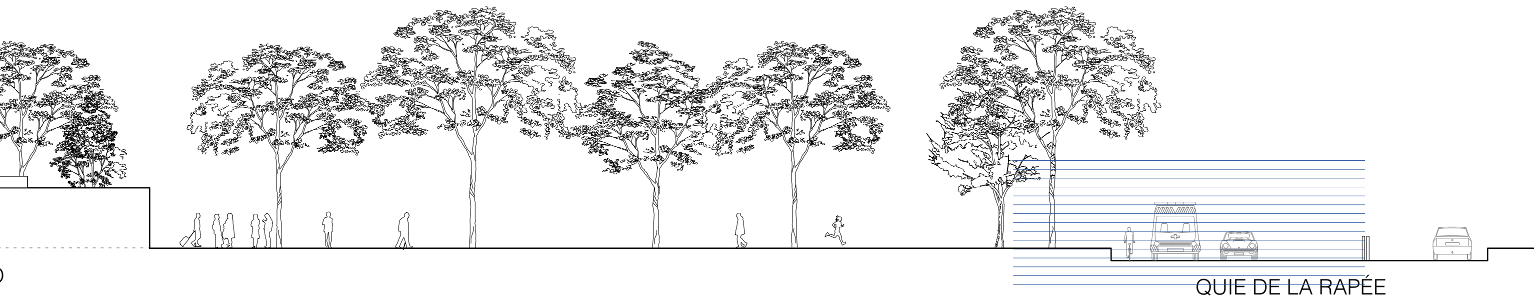

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How Will We *Act* Together?

As the past and the future lives beside the present this chapter sheds light on developments of contemporary urban discourses. The desire is to obtain a general understanding at an urban level to be able to write new pages to the story of Place Mazas, a story told in and of the city. The aim is to acquire principles from the following theoretical explorations to be able to deconstruct the complexity of Place Mazas, to eventually reinvent explored potentials as foundation for the developments of an urban strategy. A general desire to explore the notion of ***egocentric thinking***, which links the well-being of the individual to the conditions of its surrounding environment is an additional layer in the following paragraphs. Ecocentrism finds environmental and social systems being entwined, interrelated, interdependent. Such a fundamental philosophy gives ecological awareness and sensitivity an enfolding, material focus (ESSRC, 2017).

Chapter III

Contemporary architecture and city discourses
– to be inclusive to new modes of living

"Cities are complex systems whose infrastructural, economic and social components are strongly interrelated and therefore difficult to understand in isolation."
– (Jacobs, 1961)

Jacobs' way of examining the city is clearly related to an understanding and thinking of the city as complex systems complicated by physical and social patterns. Although the environmental component is absent, points of resemblance to an ecocentric understanding are clear. These '*City-systems*' can be described as large human settlements, which are characterised and defined by a permanent close spatial proximity of areas with a densely settled population. Important components of the city are the ***physical space they occupy, defined level of services provided*** and ***a pace of innovation and growth in creativity***. These components are interdependent and form interactions between the city and its inhabitants, while enhancing the quality of life (Harrison et al, 2010).

Evidently the global societal challenges influence the developments of cities and its physical architectural components. Beyond that, as a consequence of an increasingly global connectivity, societal challenges entangle all components of the developments of the contemporary and future cities. Ecological and social challenges, summons how we encounter the cities, what we desire from them and what we expect of them in the future. The understanding of current city discourses is essential to be able to build in the city – The city is for everyone, and the principle is that when one builds in the city, one is also writing new pages to an extensive and valuable history (Christiansen, 2020).

While current discourses of future cities have many similarities but not clearly entwined it is a complex field to unfold. It is not desired to examine this field to be able to incorporate one discourse of others nor is it adequate to totally preclude some of the others. Nevertheless, because of the comprehensiveness the focus will be delimited to themes of *Ecology and Social sustainability of Cities* to provide guidance on a general framing level of the project. Consequently, precludes explicit substance of themes such as the *Smart City* and *Technology of Cities*.

Ecology of Cities

The world's greater cities have through time adapted to environmental and social sustainable developments with an anthropocentric understanding, eg. Hausmann immense urban developments shortly introduced in *'A Glimpse of Paris'* (see pp. 18-19). As explained in the chapter *'A New Paris'*, (see p. 10-11), the awareness of the urgency and urban risks caused by the current climate crises seems to be permeating every aspect of developments desiring to bridge the gap between environmental and social issues. In *Towards an Ecology of Tectonics*, Anne Beim argues that ecological thinking and understanding makes sense [as a bridge between the gap] and is inevitable because of the ecological and biological crises (read qoute to the right):

"An ecological way of thinking bridges the gap between nature and culture by focusing on the interdependency between the individual (human or animal) and its surrounding environment. This introduces an ethical dimension in our relation to nature.
When interacting with nature's ecosystems we do not only affect the organization and balance of the system, but our interference also has a direct effect on our own situation by determining our future access to the resources of the system."
– (Beim and Madsen, 2014, p.30)

The quote stresses how strongly architecture (culture) is related to its surrounding natural environment. This indicates several important focal points when thinking about ecological urban and architectural developments;
Buildings and cities are shaped from the conditions provided by the natural context, thus requiring a deep understanding and awareness of the context.
Ecological developments depend on resilient design in harmony with the resilience of our ecological systems.

More implicitly, the quote touches on ideas of the need to enable constant cultural [architectural] development alongside and entangled with the natural dynamics. Hence the incorporation of terms as adaptability and flexibility, becomes extremely important when cities and its urban structures always adapt to its conditions while at the same time re-shaping those conditions (Christiansen, 2020).

Social sustainable cities

Social sustainability as one of the three pillars of the trinity of sustainable developments (World Commission, 1987) is a complex notion to comprehend and depends on which interpretation of the notion is on investigation as no commonly agreed definition exists (Stender and Walter, 2019). Nevertheless, social sustainability often appears with a set of other intangible notions such as *livability, well-being* and *the good life* as parameters which a social sustainable approach are to ensure. In this report the notion will be understood in its widest definition, hence the concept evolves focusing on both quantitative aspects and abstract and qualitative aspects, such as social coherence and sense of place.

In light of this project and the site in the heart of Paris, several urban studies have great relevance such as Jan Gehl in *Life Between Buildings* (Gehl, 1971) and Jane Jacobs in *The Death and Life of Great American Cities* (Jacobs, 1961). The crux of the matter of these studies and observations of the everyday life and social aspects of urban structures is the everyday users of the city, hence the *livability, well-being* and *the good life* is strongly linked to the social sustainability of cities. Although the two authors attack different contexts in their writings, their work will be the inspiration for both understanding the complexity of cities as well as our understanding of the project site. Jacobs' keystone is to examine, through inductive analytical approaches, how people living in balance and thriving together are related to the urban and build structures and services provided.

According to Jacobs the city is a living system, which functions by its *streets, pavements* and ***squares***. These urban components become the woven fabric in which social everyday activities can take place. In this harmony the ***connectedness*** of a city is experienced. Jacobs defines four necessary conditions, which creates diversity, hence successful cities; 1 *The need of primary mixed uses, 2 The need for small blocks, 3 The need for aged buildings and 4 The need for concentration.*

These conditions ensure the generations of life on the streets, the pavements and the squares. Traditionally, with an enormous complexity of combinations and mixing of people and functions, cities are natural generators for diversity. Consequently Jacobs put this into question (see the qoute to the right);

"How can cities generate enough mixture among uses - enough diversity - throughout enough of their territories, to sustain their own civilization?"
– (Jacobs, 1992, p. 144)

The objective is to understand the four conditions and use them actively through urban developments. As three of the conditions are related directly to the existing structures of the near context of the site of Place Mazas, the main condition relating to the development of a new architectural structure is the first condition; The need of primary mixed uses. Jacobs' presentation of this condition will be the starting point of the chapter; '*The hybrid mixed-use building*' (See p. 44).

According to Jacobs in combination these conditions can generate an almost instinctive, informal and natural balance of common harmony and expectations. ***The connectedness of diversity and mixed uses ensures control, safety and activity and can also help initiate action to boost social sustainability and resilient urban transitions.*** In addition Jacobs highlights urban developments as being slow processes which evolve over time along ever changing conditions, thus a link to the importance of careful awareness of surrounding conditions explained by the understanding of ecological urban developments.

So,
How Will We Act Togehter?

To enhance all the above and create a connection as strong as possible to the surrounding context as the theoretical explorations highlights the project will work actively with energies of current urban and infrastructural affairs presented in the first chapter. This will be the freamwork of the Urban Design Layer, which grounds the explorations of the next chapter This is the crux of the matter in the next chapter IV, *How Will We Live Together?*

How Will We *Live* Together?

"We need a new spatial contract. In the context of widening political divides and growing economic inequalities, we call on architects to imagine spaces in which we can generously live ***together****."*
- Hashim Sarkis (La Biennale Di Venezia, 2021)

The 17th edition of the Architecture Biennale in Venice 2021 entitled *"How will we live together?"* curated by Hashim Sarkis, will be the inspiration of this chapter. In an urban context (explored in the previous chapter III) the open question emerges from the necessity to both look at the conditions of the city and its physical building structures to figure out new paradigms to design the space in which we live. Paradigms that are inclusive to both actions on the ecological crisis and to new modes of living (La Biennale Di Venezia, 2021). The following paragraphs will examine the subject, by explorations in an architectural building scale.

Chapter IV

The hybrid mixed-use building

This chapter will examine the qualities and challenges of the *hybrid mixed-use* building as an architectural building typology. The understanding of the theme is based upon its relation to ecological urbane developments through studies by Jane Jacobs with *The Death and Life of Great American Cities* from 1961 and the text *Towards an Urban Design Manifesto* by Allan Jacobs and Donald Appleyard (published in 1982, prolog of Allan Jacobs published in 1987).

As Paris exists as a densely populated city with small blocks and aged buildings the conditions for a diverse, inclusive and successful city with *mixed uses* is present according to Jane Jacobs (Jacobs, 1961). Currently the city undergoes major developments to exploit and stimulate these, sometimes hidden, potentials by among others, restrict the prospects for hard traffic in areas which once were pedestrianised. This to promote the *connectedness* of streets, pavements and neighbourhood parks, being the city's most *vital organs.*

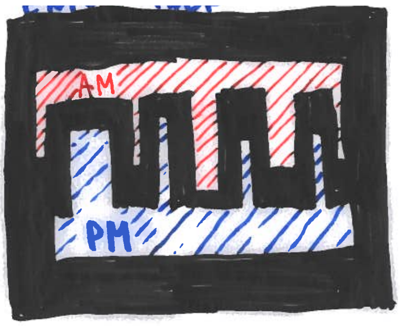
According to Jane Jacobs the potential and necessity of mixed-use is the gathering of different users at different times, which consequently generates social diversity, increased safety and comfort in the city. By this Jacobs indicates the importance of *connectedness* between *users, functions and time*, which only gets stronger the more complex and diversified the system it contracts to is;

"The district, and indeed as many of its internal parts as possible, must serve more than one primary function; preferably more than two. These must insure the presence of people who go outdoors on different schedules use many facilities in common."

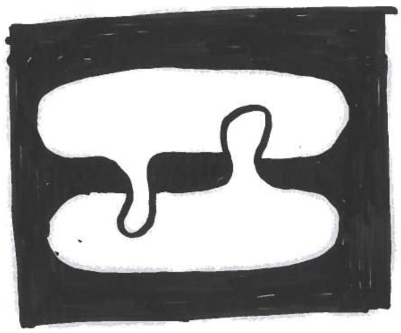
– (Jacobs 1961, p. 150)

For the promotion of this complexity Jacobs argues that a mix of commerce and public services with housing and accommodation is one of the strongest tools to generate diversity with mixed-use; *"As it is, workers and residents together are able to produce more than the sum of our two parts"* (Jacobs 1961, s. 153), as long as the mix does not bore of reple the users of one or the other.

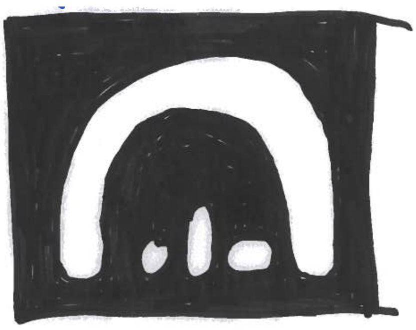
In continuation, to ensure harmony between users and the context, Jacobs defines ***primary functions*** as *local anchors* which attract people, when they are adapted to the local contextual conditions and characteristics and simultaneously match the public expectations. When it succeeds to develop primary functions out of the city's resources it is possible for ***secondary functions*** to evolve over time. Consequently it must be possible to develop mixed-use buildings which are robustly anchored, hence ensuring adaptability towards ever-changing urban conditions discussed in chapter III: *How Will We ACT Together,* p. 21. The illustrations (Illu. 18) concentrate the explored thoughts by Jacobs, and will function as primary guidance in the development of programming the *Place Mazas square.*



TIME enterwined



FUNCTIONAL enterwined



ARCHITECTURAL enterwined

18. Mixed-use diagrams inspired by the thoughts of Jane Jacobs.

Typology and functions on site

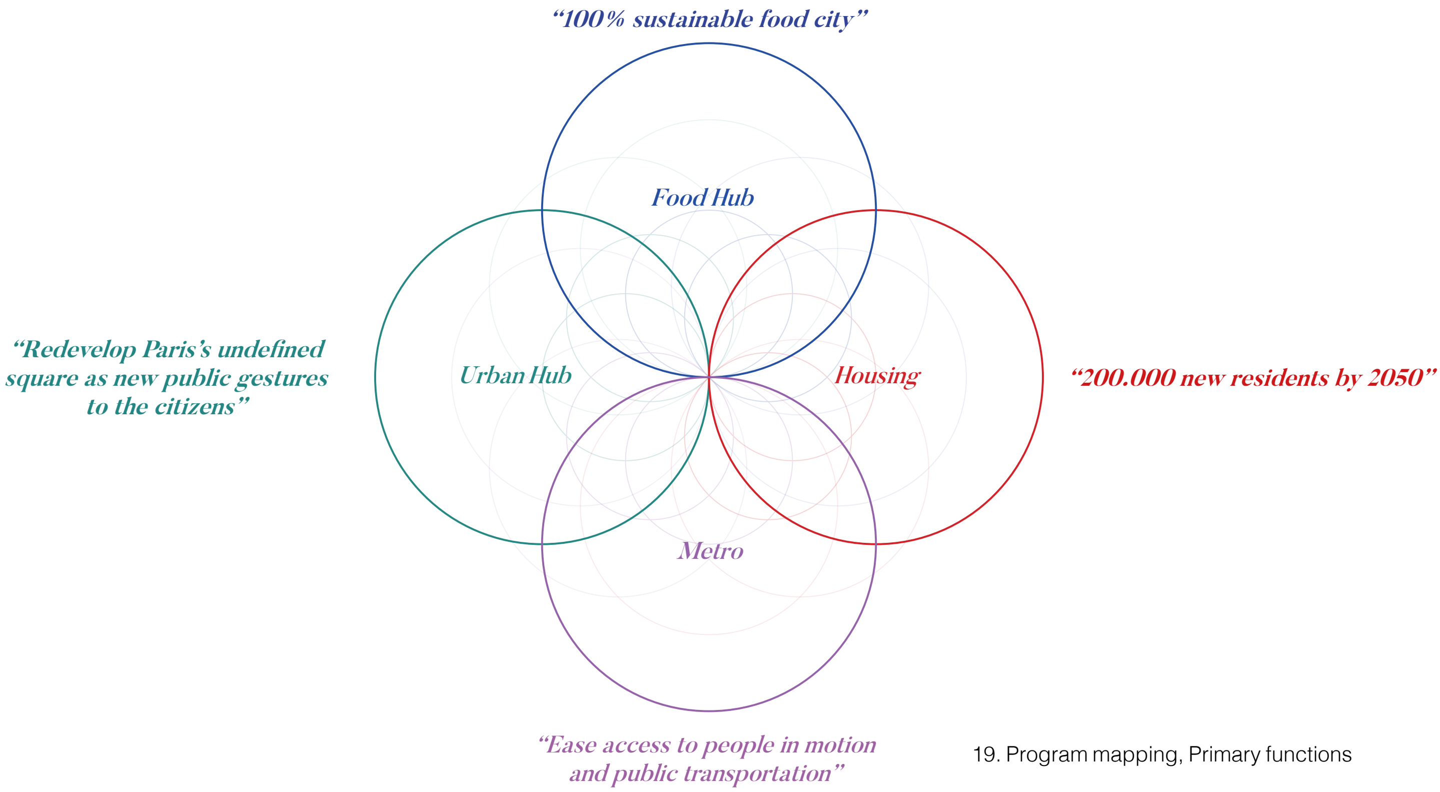
As the previous chapters have stated, new urban developments need to be inclusive to both actions to boost social sustainability and the creation of resilient urban structures. To concretise these theoretical and thematic considerations the report *Paris Climate Action Plan* has been thoroughly examined (City of Paris, 2018). The report consists of comprehensive action for 2030 and ambitions for 2050 to combat environmental and social aspects due to the current climate changes in tandem. The report can be criticised and degraded to be a set of policy statements without specific mechanisms to follow both in the perspective of architects, developers and everyday citizens. The document is screened for possible specific functions of the new Paris city presented both explicitly or implicitly between the lines to enable the creation of a new program for Place Mazas square.

Based on the previous chapter exploring the mixed-use term it is desired to select functions for the three pillars; ***housing, public*** and ***urban*** facilities that are suitable for the future (2030-scenario). The overall *program mapping* (Illu. 19) shows four selected functions, which are assessed to have potentials of being the new primary functions on Place Mazas square. Each with a statement inspired by *Paris Climate Action Plan*. The four presented functions; *Food Hub, Housing, Urban Hub* and the *Metro*, are selected based on the goals to propose a relevant and realistic functional program affecting an everyday citizen perspective, which explicitly responds to the political-strategic perspectives of a sustainable future city.

The food sector is responsible for almost 18% of the Paris carbon footprint, thus the city desires to move towards a sustainable and self-sufficient food city. Based on this the objective of the city is to improve *awareness, shift behaviours* and *habits* and i*ncrease accessibility* to sustainable food (City of Paris, 2018, p. 49). It is believed that the creation of a Sustainable Food Hub with relation to an Urban Hub has the potential to be visible new structures on the site capable of attracting attention and be an affecting element. The actuality of a sustainable food hub is further enhanced by Placa Mazas urban logistics in the heart of the city. This function theme corresponds both to public and urban facilities, whereas the actuality of housing must be grounded in other circumstances.

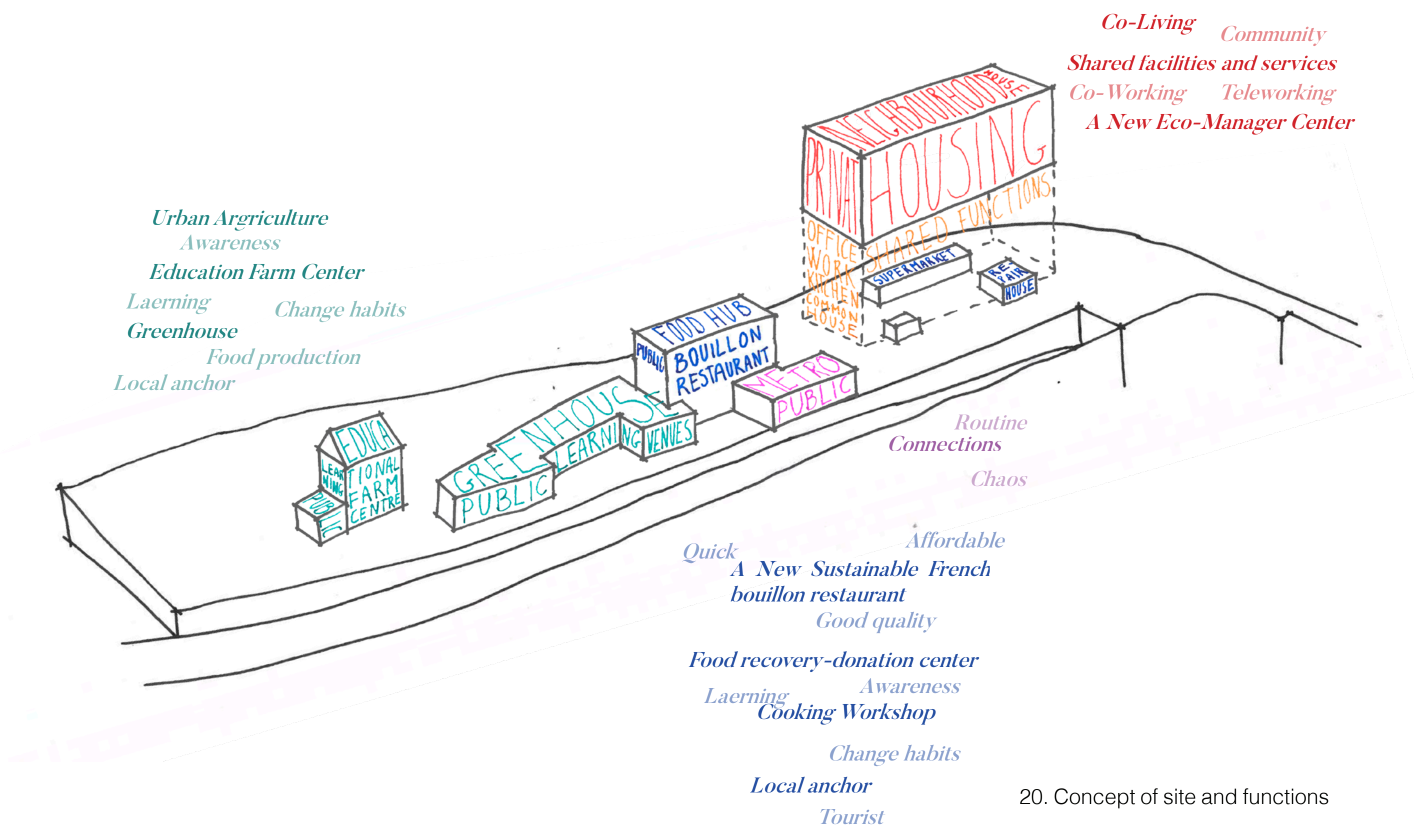
The city of Paris must prepare to simultaneously be able to, over the next 30 years, continue to accommodate new residents, with an additional 200,000 Parisians expected between now and 2050. This is a massive challenge that requires a faster rate of execution while further improving the quality of dwellings. With this intensive ambition to accommodate new residents and improve old buildings, there is no specific mechanism on how to perform the executions (City of Paris, 2018). The project will grasp the widest definition of ***new modes of living*** with foundation in the principles of shared properties and functions and terms such as small living, inspired by Anne Hidalgo's quote in the following. This calls for innovative solutions, which will be explored as part of the primary function of housing. It is desired to challenge how to make new kinds of homes, where users can live happily for many years, without making it the main focus of the project. It is explored as an attractive asset of a mixed-use and diverse programming of Place Mazas.

"It is more important than ever to develop projects that will bring us together and promote our diversity, projects that will build bridges between communities, territories and sectors of activity. We must draw on our rich cultural diversity and the immense potential of our inhabitants, enterprises, start-ups, associations, researchers, craftsmen, businessmen, and all the people who make up our cities."
– (Hidalgo, no date)



19. Program mapping, Primary functions

Housing + Food Hub + Metro + Urban Hub = The New Place Mazas Square



20. Concept of site and functions

So, How Will We Live Together?

As part of the definition of a city as a densely populated area naturally capable of generating diversity and as the title of chapter indicated by the word 'Together' we must seek new solutions collectively. Not merely new paradigms enhancing human life, but paradigms collectively connected in an ecological and ecocentric understanding. This by; having a great focus on contextual conditions of both society and nature, embrace the harmony of resilience in design and resources and design with the awareness of the ability of constant re-shaping of conditions. ***Connectedness*** as a notion which holds these aspects to it will be used to perform quality assurance in the design process. These observations will be the catalyst to develop the overall *Architectural Design Layer* enhanced on top of the *Urban Design Layer*. The next chapter unfolds the next Design Layer, exploring *How We Will Build Together?*.

How Will We *Build* Together?

'How Will We Build Together?' implies great reflections upon a huge and complex history of the building and construction industry. This chapter is inspired by the acknowledgement of complexity and the belief that current design thinking in architectural developments needs to cover larger systems to design for the future.

"The architectural applications of this way of thinking should be immediately evident – it's important to design the material, the factory, the building,and even new building typologies at the same time."
– David Benjamin (Benjamin, 2017 pp. 23)

This larger system of a complex wholeness where every part in different scales fits to another. The window must fit the house, as the house must fit the site and the city (Lauring, 2010; Beim and Madsen, 2014). To go even further; the material must fit to the structure, as the structure must fit to the expression which must fit to the intentional vision. Architecture must fit the culture which is a result of environmental and social conditions.

Chapter V

Ecology of tectonics

The key concept within the focus of tectonics is the relationship within parts and whole, the essence in constructing and construing (Madsen, 2014 p. 99).

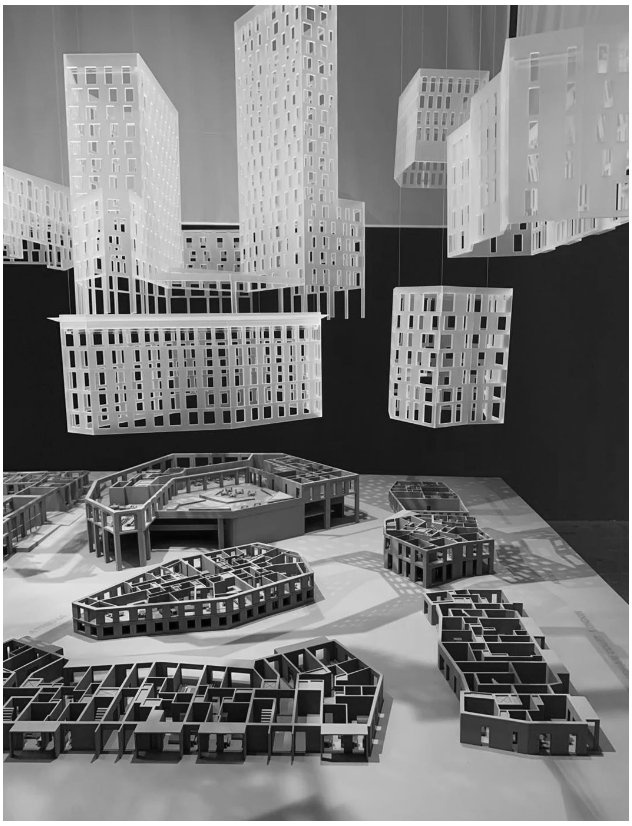
"That is to say the 'construction' and the 'construing' of architecture are both in the detail. […] Details are much more than subordinate elements; they can be regarded as the minimal units of signification in the architectural production of meanings."
– Marco Frascari (Madsen, 2014 p. 99)

Early definitions of tectonics have reflected far simpler circumstances and less complex problems than what we are whiteness to today. Our use of materials, traditions in craftsmanship, and used technologies has evolved significantly. When we in contemporary society address the subject of tectonics, the understanding of parts and whole, it is inevitable to discuss an ecology of tectonics. An ***ecology of tectonics*** embedding the concept of buildings as parts being tied together as a whole in a broader context of natural and cultural systems. This definition of tectonics also creates a new ethical dimension, forcing us to consider the coherence of used materials, the ecosystems they are a part of, and the resources that we share on earth. One of the questions in this discussion is how to ensure a common foundation for a holistic and sustainable architecture that supports societal prosperity without compromising the living systems on earth. Sustainability has become a premise on which all architecture is created and we as architects have trustfully accepted it (Beim and Madsen, 2014 pp.20-23).

The way in which we design architecture has additionally changed drastically with the advanced progress of software. As a result of this progression the content and procedure for architectural practice has shifted focus from 'design' to 'management'. Contemporary construction industry, driven by global trends and economy, has made it difficult to create a regional cultural identity and a holistic construction in architecture (Beim and Madsen, 2014 pp.20-21). Efforts to achieve environment friendly solutions can be one of the more critical consequences created by international political agendas concerning the reduction of energy consumption and CO_2 emissions. The 'energy discourse' appears to be critical and tends to lead to somewhat dogmatic interpretations of the problems. Despite the good intentions concerning lowering energy consumption, it seems to lead to adverse implications of the architectural design (Beim and Madsen, 2014 pp.20-23).

So, how do we learn to navigate in this sustainable crisis, and once again become 'designers' instead of 'managers' in the creation of architecture? How do we turn this environmental crisis into our architectural platform upon which we create architecture of great quality, an ***ecological tectonic***, that will stand for hundreds of years and inspire the way we live and build together on this one common planet? The very extensiveness and complexity is unfolded by Utzon with an inspiring comparison between architecture and nature (see next page). From the perspective of architect Ulrik Stylsvig Madsen (Madsen, 2014 pp. 99-111) we need to rethink the way we construct our physical surroundings in the light of the industrialization of the building process. A new relationship between parts and wholes must be introduced to accommodate the complexity in the way we build.

A tectonic approach to architecture is dependent on the construction created by the architect and the construing performed by the user. Thus, becoming a rather complicated process in the understanding that the building holds no meaning until it is perceived by the spectator and solely depends on the knowledge and experience of the individual. This dynamic way of looking at perception calls for a strong tectonic strategy that can be understood in cultural and social systems in constant development. Perhaps the solution is within creating a clear and simple tectonic concept which can easily be understood by the user without any prior knowledge on the field. This ensures the logic of a given building to be embedded in a cultural and social system which is ever changing (Madsen, 2014 p. 110).



21.

"The true innermost being of architecture can be compared with that of nature's seed, and something of the inevitability of nature's principle of growth ought to be a fundamental concept in architecture. If we think of the seeds that turn into plants and trees, everything within the same genus would develop in the same way if the growth potentials were not so different and if each growth possessed within itself the ability to develop without compromise. On account of differing conditions, similar seeds turn into widely different organisms."

– Jørn Utzon (Beim and Madsen, 2014).

A critique of the building industry

Sustainable tectonics
The current building industry is driven by an overwhelming amount of quantitative requirements and standards that should be fulfilled in the name of sustainability. The initial idea of developing tools that should ensure a sustainable solution is a positive contribution in achieving a more sustainable future. Building regulations, sbi-standards and quantitative sustainable certification methods (DGNB, Leed etc.) are all developed to secure a certain sustainable quality. This development can be argued to have set a huge barrier in designing architecture of high quality. The majority of the architecture designed today is defined by energy efficiency which increases the risk of homogeneous geometric buildings with plane facades where all the structural elements are hidden in insulation (Andersen, 2019). Sustainability is observed as something functional and not aesthetical (Andersen, 2019). This development gives the architect a substantial and exciting challenge to integrate sustainability and tectonic aesthetics and thereby give the user a positive architectural experience that guides the user to be pro-environmental (Abusafieh, 2020, p. 656).

Certification culture
"Architecture criticism is in danger of disappearing at the very moment when we need, more than ever, a searching and sustained critical conversation about the built world."
– Tomas Fisher (Baus and Shramm, 2015, p.118).

The planet is facing an ever growing environmental crisis and demands immediate solutions for a sustainable future. The building industry is one of the world's largest consumers of CO_2, energy use and material use (Global Alliance for Building and Construction, 2020) and therefore has a large influence on the sustainable processes. The current sustainble solutions that dominate the contemporary building industry are quantitative certification methods like DGNB, LEED and NET-zero-energy building. This gives operators and stakeholders a tool to ensure a sustainable product. These methods do however have a large impact on the architectural diversity of the current new build townscape. The certification manuals that are developed to ensure a sustainable future are not necessarily used for that purpose, but are instead used to achieve status and good recommendation. This has generated a certification culture where the architectural and tectonic qualities are neglected (Baus and Schramm, 2015, pp.118-119). ***Has it come to the point where it seems to be approved to promote yourself based on these scores and diplomas?*** Architects are tracing the points of the schemes so narrow-minded that aspects, which the schemes claim to embrace, become distracting objects. ***Is there a risk of architects overlooking considerations of people living in and around the designed building caused by too much time used to reach the scores perceived as sustainable? Are we forgetting the social aspects in the middle of terms of energy consumption, life cycle assessments and points in an excel scheme?*** (Shove, 2018)

The building industry is run with a heavily dominant quantitative approach where the architectural qualities are neglected. This prepares the ground to investigate how sustainability and tectonic architectural quality can be integrated. This will be a focus point of the project. The project is willing to compromise certain quantitative requirements to achieve a more balanced qualitative and quantitative approach.This by using technical tools such as BSim and Be18, as integrated ***design drivers*** feeding a creative process, hence quantitative and qualitative aspects are fused. The project will naturally use the current standards as a guideline, but will not necessarily blindly fulfil all standards, but will evaluate if a specific standard can be modified and still maintain a responsible sustainable solution and simultaneously design tectonic architectural quality.

Buildings of the future

Climate action plan for Paris
The Climate Action Plan generally has a large list of overall visions on how the city of Paris should develop in a sustainable and carbon neutral direction, but encourages operators in the industry to have innovative working methods and provide innovative solutions (City of Paris, 2018, p. 47). In addition the city of Paris will give an “experimentation permit” regarding reuse of materials, energy performance, environmental performance and characteristics (City of Paris, 2018, p. 37). The Climate Action plan argues that:
“it [The experimentation permit] will allow for the waiving of some of the rules in force by setting actual performance targets instead of theoretical obligations that currently impose restrictions on building design without always guaranteeing the expected performance levels.” (City of Paris, 2018, p. 37).

Carbon Neutrality through collective actions
Carbon Neutral Buildings (CNB) is an incorporeal concept that can be defined and understood in various ways. The main dominator for CNB-projects is having a design approach including the following focus points: *Integrating passive design strategies, designing a high performance building envelope, specifying energy efficient HVAC systems, lighting and appliances, Installing on-site renewable energy and offsetting* (Carruthers and Casavant, 2013, p. 1).

The concept has been defined in a vast number of ways, where both the terminology and core requirements of the definitions are defined in different nuances through time (Causone, Tatti and Along, 2021). In the article “From Nearly Zero Energy to Carbon Neutral: Case study of a Hospitality Building” the authors conclude that a single urban building can not achieve carbon neutral objectives by itself, due to the lack of space to install onsite offsetting. Carbon neutrality can be better realised in bigger scales like on a city or national scale (Causone, Tatti and Along, 2021, pp. 21-23). The project will therefore define its own delimitation and definition of a Carbon Neutral Building that is based on the literature presented above and additionally address how the project will work alongside the ambitions in the city of Paris. Since the newest literature indicates that carbon neutrality is better achieved through larger scales, the project will try to acommitated the wishes form the *Climate Action Plan* of Paris and not focus on how the building soly can be carbon neutral. The project will take use of the ***experimentation permit*** described above, as a unique opportunity to have an innovative and creative technical working method toward the building of the future.

Inspired by the presented goals from P*aris Climate Action Plan* and the definition of Carbon Neutral Buildings the project will in particular follow the listed focus points through the design process of the *Architectural Design Layer* and the *Technical & Structural Design Layer;* ***Integrating passive design strategies and critically compare results of indoor environment conditions and the energy frame.***

So,
How Will We BUILD Together?

To be able to grasp the comprehensive complexity of contemporary building practice and understandings of tectonics, the projects will actively work with the development of a solid architectural-tectonic approach guiding the process developments. A initial approach:
How can the matrility, form and arrangement of structural elements create a building that respects the existing and balances indoor environmental conditions with an efficient energy performance?

The architectural-tectonics approach will continually be reinvented to boost the *Technical & Structural Design Layer*. The priority is to be able to ensure a sustainable architecture that will be utilised for many years by creating convincing architectural and tectonic quality instead of merely a focus to achieve energy sufficient architecture.

Studying
Investigating
Experiencing

How Place Mazas ACT, LIVE & BUILD

How Will We ACT, LIVE & BUILD Together has now been presented and introduced through theoretical explorations and studies with the previous three chapters. This chapter desires to unfold the three Design Layers corresponding to ACT, LIVE & BUILD, by studying, investigating and experiencing the site Place Mazas square and its contextual conditions. The following work is inductive demonstrations of the theory as well as an exploration of Place Mazas and the near context. Thus the focus is on unfolding the found and existing, while the next chapter focuses on *Challenging, Creating, Consolidating* the *Design Layers* (pp. 18-19). It is an increasing phenomenological and chatograchical understanding of the site, hence the site is explored in different ways highlighting; material, emotional and conceptual settings.

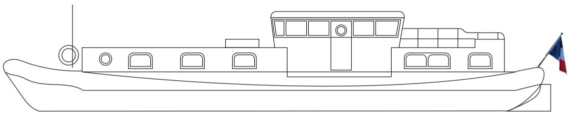
Chapter VI

Especially the phenomenological analyses has been a great focus to explore the way the site and its context is perceived and experienced (Steinø, 2016, p. 6). The analyses are conducted to discover the inherent potentials and challenges of the Place Mazas square. The explorations can be described as an observational practice of the existing world. Like a *flâneur* in the city, it is possible to perceive reality with a fresh view. Curiosity and fieldwork is the starting point to develop architecture for the future.

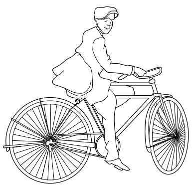
22. Conceptual near context : 2030-scenario, 1:5000

Bastille

Morland mixité capitale, David Chipperfield



Bassin de l'Arsenal



PER Velo 2030

PARC de RIVEER SIENE2030

Olympics 2024
Opening ceremony departure

Jardin des plantes

PER velo

arrondissement

recreational area

Ⓜ metro

Ⓑ bus

Sum of the parts

The Place Mazas square can be thought of as an *urban island*, an undeveloped crossfield, conceptually existing as a constrained courtyard as mentioned in the chapter *A New Paris* (p. 11). In this crossfield the site exists in a unique and diverse urban fabric surrounded by attractive uses such as *Bassin de l'Arsenal, new parks along the Seine and Jardin des plantes*. Today the square exists merely as a transition from one place to another, intensified by the metro station, without any relations to them. Following Jane Jacobs' understanding of the city as described on page 40+44, hence the relation between squares, streets and pavements and their relations to the contextual conditions it seems as if the site is surrounded by unexploited potentials of a diverse mix of users and functions.

"...like all neighborhood parks, it is the creature of its surroundings and of the way its surroundings generate mutual support from diverse uses, or fail to generate such support."
– Jane Jacobs (Jacobs, 1961, s. 98)

Exemplified by neighborhood parks Jacobs initiates the importance of relation between functions and context, more precisely the life in the context. The characteristic of the surroundings betokens not failure of the surroundings to generate support, but a failure of Place Mazas square to utilize the support. The mapping of the near context showcases how these synergies meet and cross the site, without an apparent exchange between them. It is the desire to extend the existing functional layers and intentionally create connections which embrace the mixture and diverse city landscape.

A New Place Mazas Square
To activate the inherent potentials of Place Mazas it is needed to design a space which acts in extension of and embraces coherence between the surrounding functions. A space has no value, before it connects with the conditions of the context. Rephrased, the life and people in the context implicitly determine the abilities of the urban island. ***The greater intention is that the value of the connectedness is more than the sum of the parts.***

A Flâneur in the city – everyday gaze

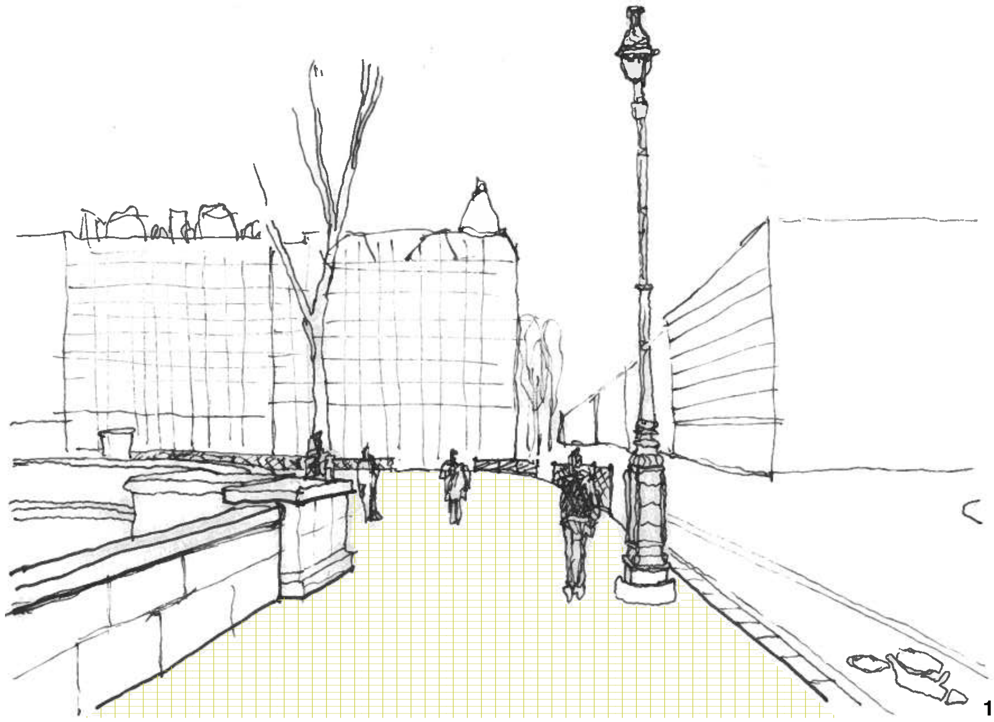
First-hand impressions

A conversation of the first-hand, unfiltered impression of the site, was recorded in Paris. The site was approached from three different points (Illu. 23) and the recordings have been pieced together to a sum of words characteristic for the experience.
Characteristic for the first meeting with the site was the experience of wind. Approaching the site from point [1] and [3] made it clear that the site was rather windy compared to the starting points of the routes. This is a direct consequence of the openness and the connection to the wide river Seine. During the summer month and heat waves the exposed locations could be assessed as a great quality. Furthermore the chaos of traffic and people in transit has shown to be an inevitable characteristic for the site. Summarised of route [1] and [2] a general experience is the perception of a rather spacious site compared to the more narrow streets. A quality of experience the project desires to enhance through the architecture and tectonics.

hourly Data: Wind Speed (m/s)
city: PARIS_ORLY
country: France
source: IWEC Data
period: MAY to OCT
calm for 1,59% of the time = 70 hours
each closed polyline shows frequency of 1,2 % = 50 hours

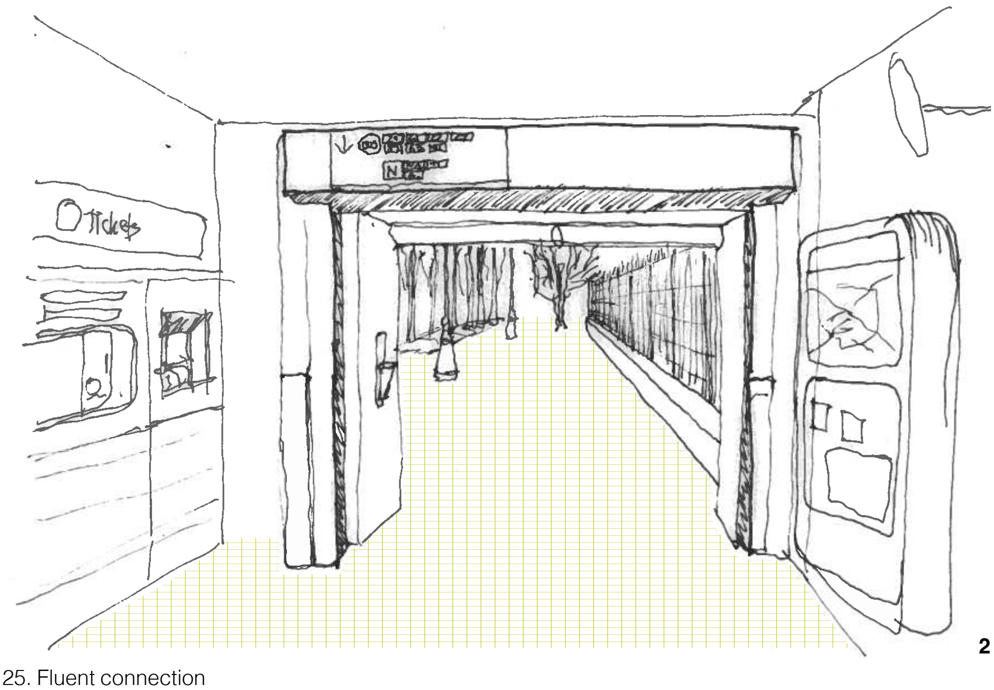
23. Phenomenological analysis of first-hand impression

Arrival to site



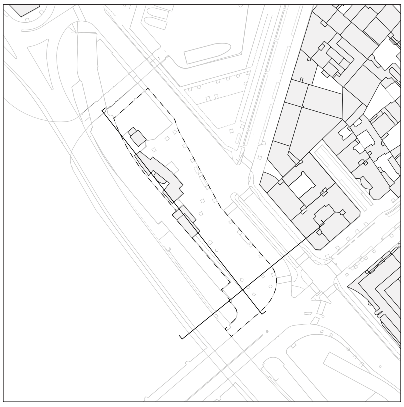
1

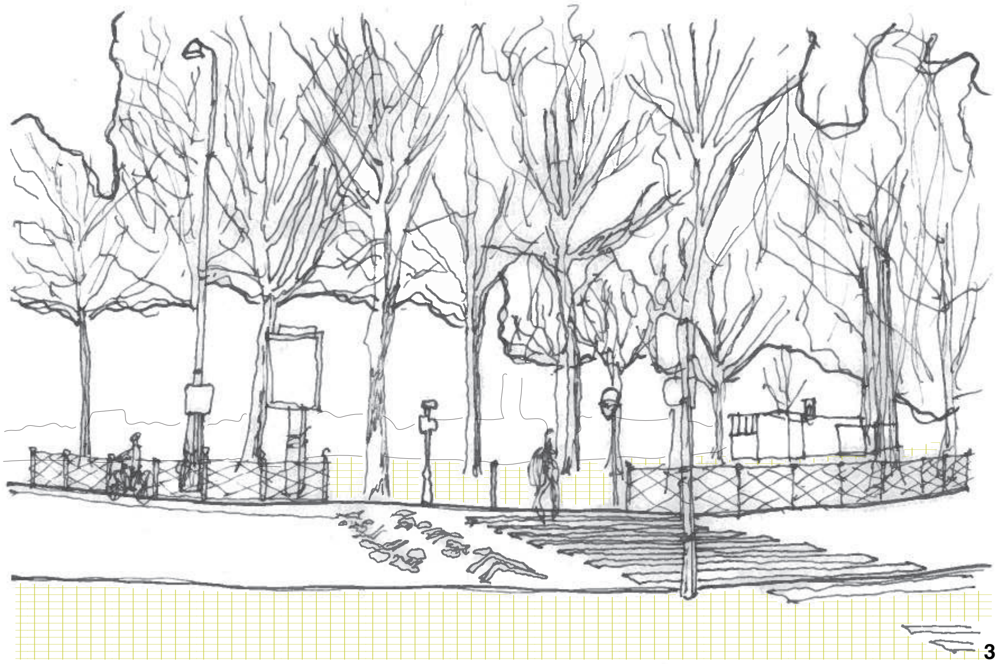
24. Fluent connection



2

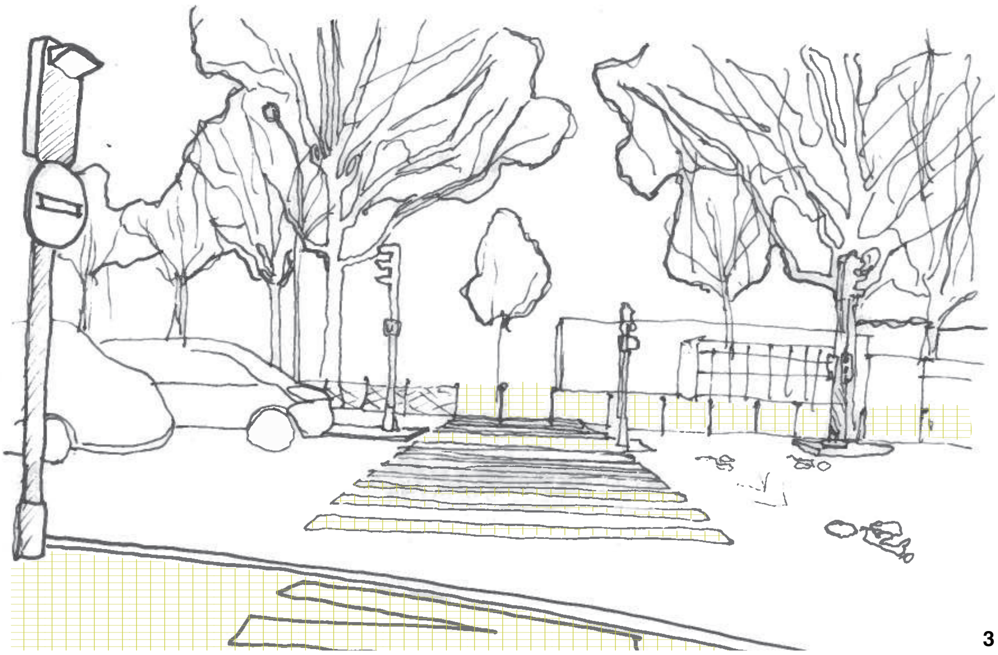
25. Fluent connection





3

26. Blocked connection

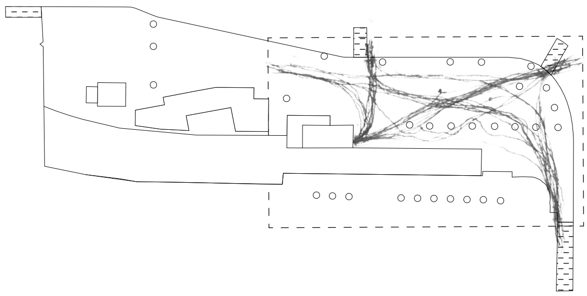


3

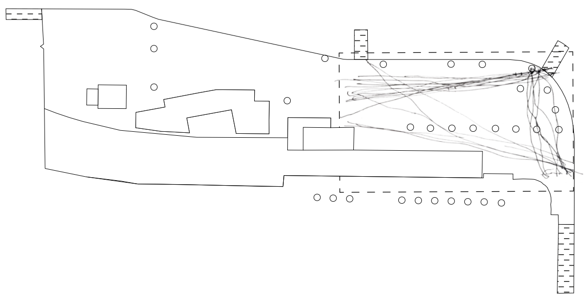
27. Blocked connection

People in motion

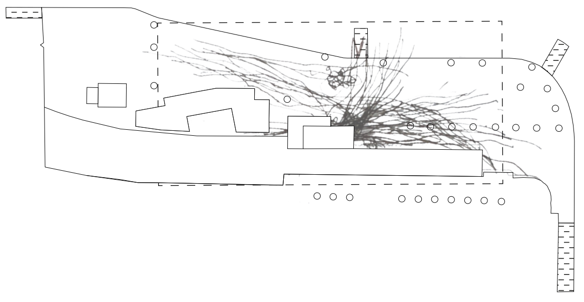
The illustrations (Illu. 28-31) is the result of *statically observation* of the flow of pedestrians on the site at 4 different times throughout the day. The flow patterns indicate an inhabited composition of everyday life, dominated by transit and connections through the city. Besides highlighting activity, this pattern illustrates potentials for the opportunity to create different target spots for developments (Illu. 34), which could change situations to inhabited spaces that can be occupied by the users and adapted to their personal needs. Sketches conducted on site during the study-trip concentrates interesting aspects in the merge of ***flow, the trees and physical architecture volume.*** It indicates a creative intuition of these aspects being interwoven.



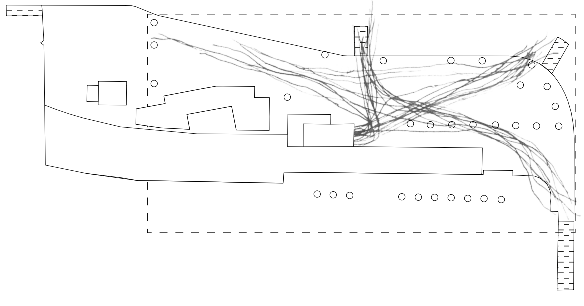
28. Wednesday 23/2/2022 8.00-8.11 am



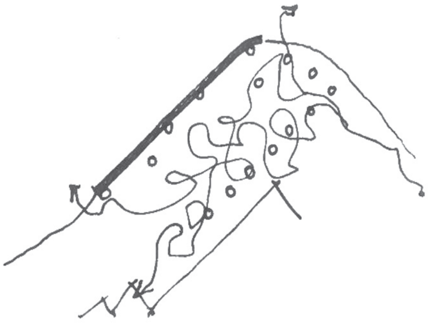
29. Tuesday 22/2/2022 13.46-14.01 pm



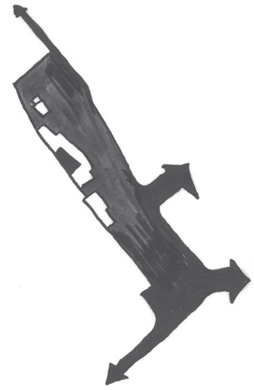
30. Tuesday 22/2/2022 4.43-4.54 pm



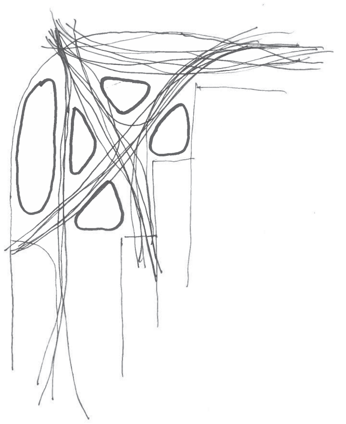
31. Thursday 24/2/2022 8.37-8.47 pm



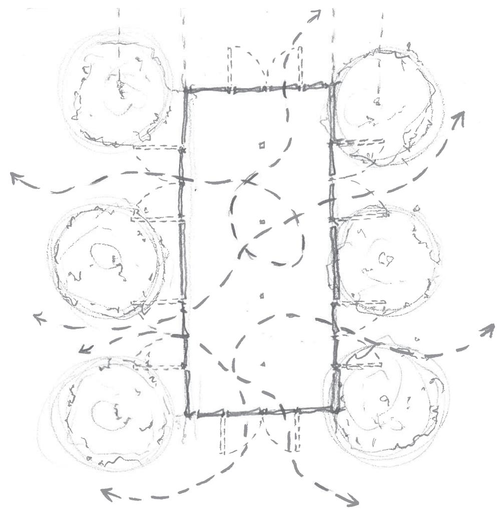
32.



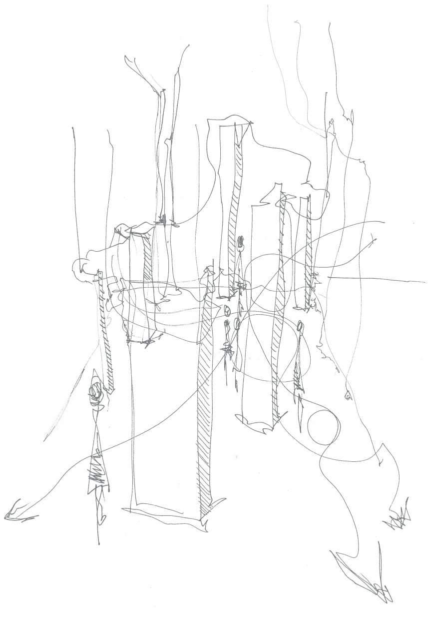
33.



34.



35.



36.

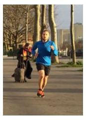
37.

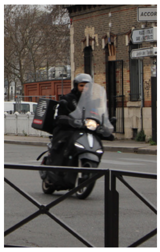
Sketches conducted on study trip, Paris – 20.02.2022-24.02.2022

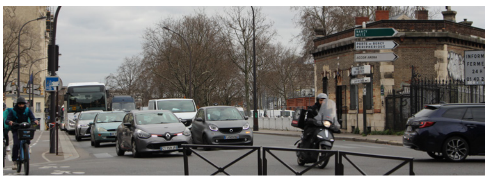
“People come
People go
Pass by and then continuing
They are speaking French
A smoke in his mouth
Vibrations from the metro travels through the stone on which I am sitting
Sirens rush by as a shout out in the continues conversation among cars
– a cheerless monologue
Motorbikes speaking a different language
Wind is gaining strength
Haussmann in disguise – a temporary expanded three-dimensionality
Monologue – breathing – monologue
Who shouts the loudest?
There is no stagnation except me and the existence of the trees“

38. An attempt to observe a Place Mazas – 22.02.2022 – 13.48-13.57

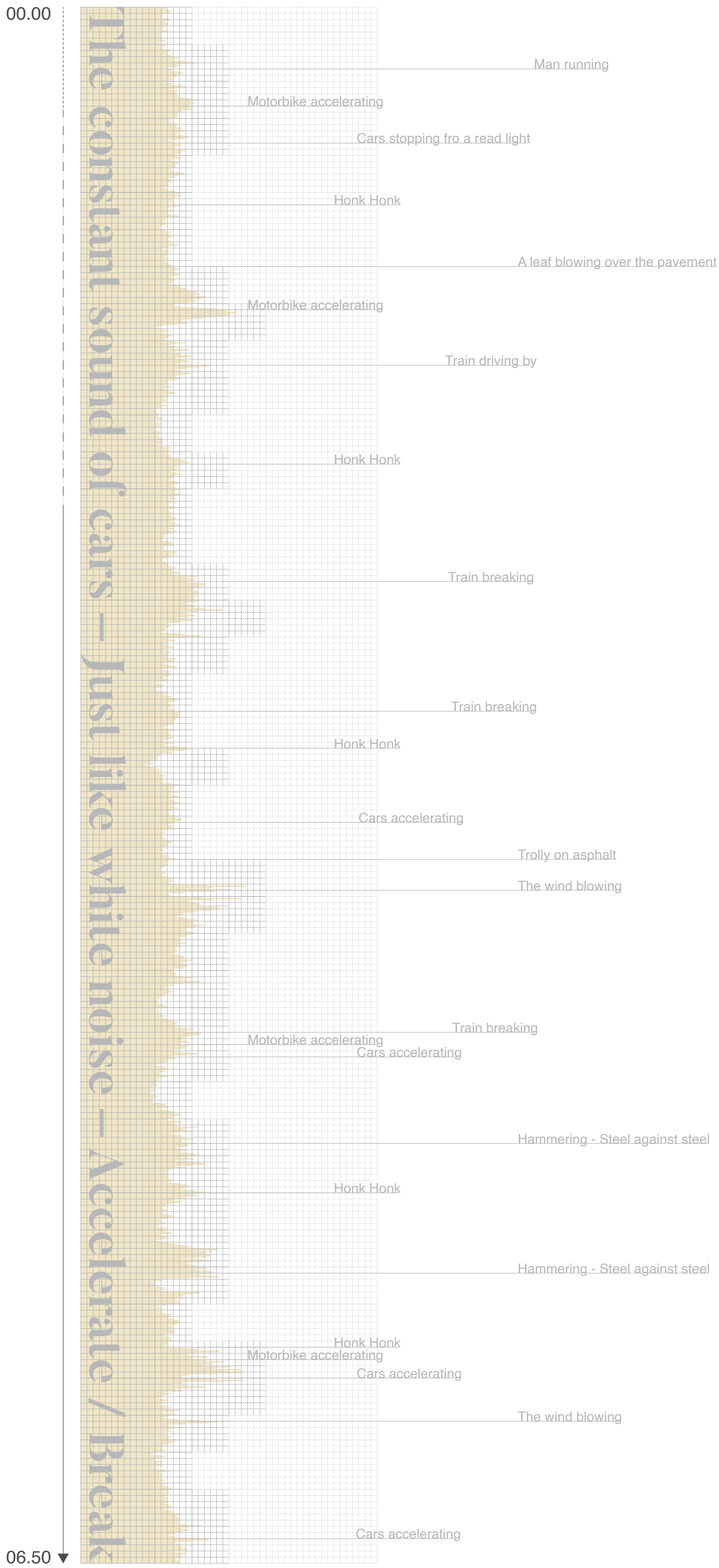
00.00







06.50

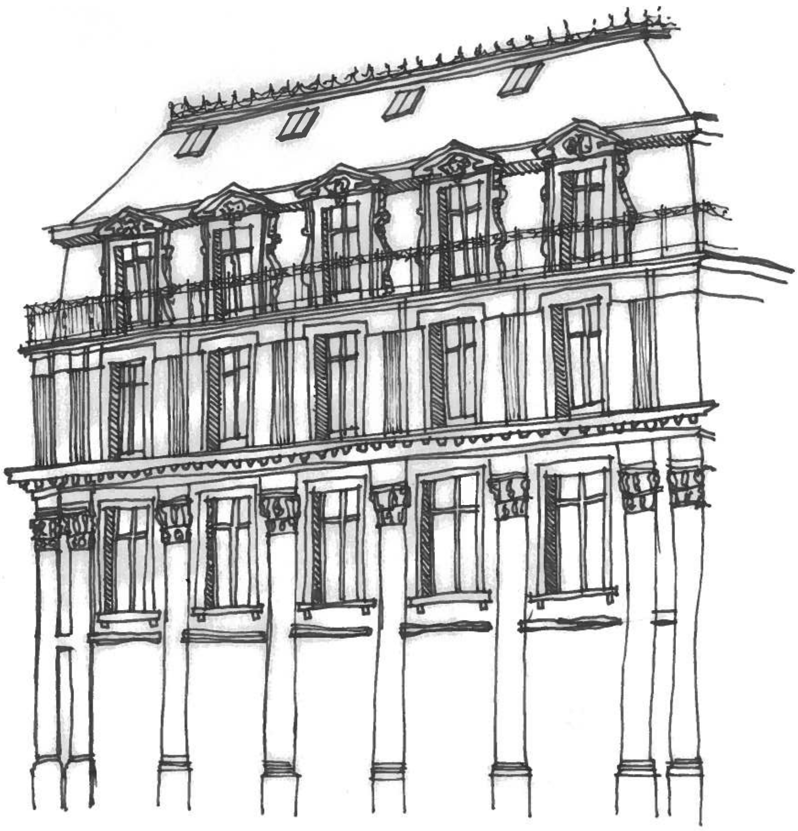


39. An attempt to auscultate Place Mazas, Paris – 23.02.2022 – 15:20

Collected language

The objective of this chapter is the found and existing in the surrounding context of Place Mazas Square; the streets of Paris, its physical elements in a range of scales; *facades, construction, tectonics and spatial surroundings*. The desire is to understand the language of Paris in a metaphorical way. With inspiration from Rem Koolhass's *Elements of architecture* (Koolhaas, 2018), different architectural elements and parts create a whole, a ***'Collected language'***. This language needs to investigate it, to be able to speak it [conduct a design proposal]. On a conceptual level the method to do so will take inspiration in the linguistics of the language, which is the scientific study of human language, meaning that it is a c*omprehensive, systematic, objective* and *precise* study of language.
To create critical and creative design thinking in the development of future architecture, it is desired to encompass the analysis of selected aspects of a ***'Collected language'***, to be able to develop methods and principles for modelling it in the design process.

Why is the reading of the book of Paris, one of those you wish never ends?

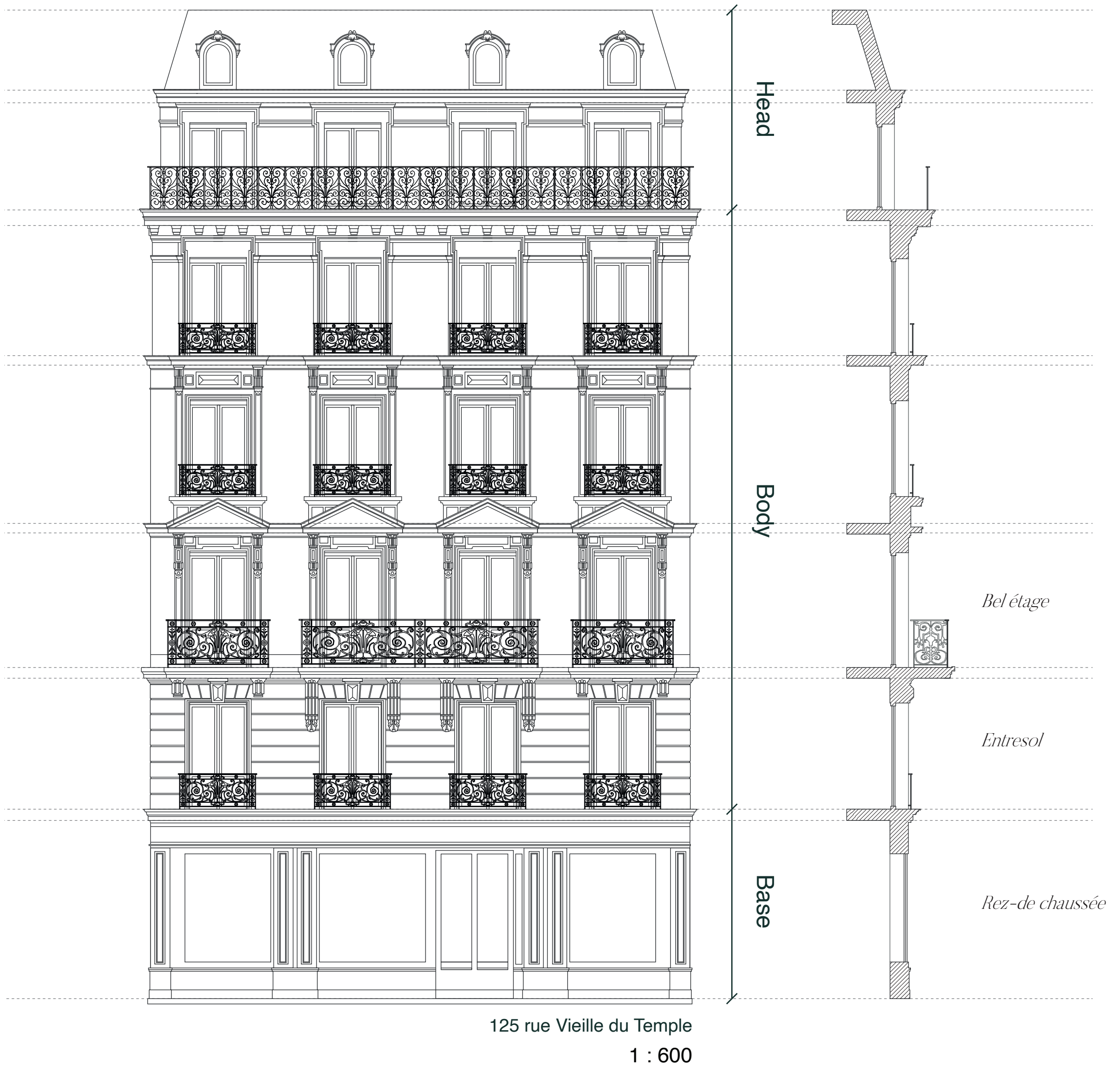


40. Sketch of Haussmann facade

Paris and its basic sentences
– a matter of rhythm and layering.

The basics of a sentence. At the least a sentence must consist of a subject and a verb. The distinctive Haussmann planning and architecture created in 1853-1870 that transformed Paris into the city we know today is an important structure of the *Collected language* to understand while it is of such great importance and character to Paris. The façade tells different stories, among others of the hierarchy of social class existing in the late 19th century. The lowest social class living under the roof in the top apartments and the highest social class and the wealthiest on the 2. floor. Shops and public functions were to be found on the ground floor as it is seen today (Jacobsen, 2006).

The facades tell a vertical story of layering, rhythm, and proportion. Detailing and ornaments dominate and tell an incredible story of craft in architecture that we no longer know of in contemporary society. It is possible to divide these *façade stories* with its layering into a ***base, body and head***, (Illu. 41) which creates a connection to the human scale. The proportion of the facades create a continuous expression along the streets of Paris.



41. The arrangement of the base, body and head, 125 rue Vielille du Temple

A language of craft

As the illustrations show, Paris exists in many variations of the *base, body and head* arrangements. In a more detailed view the facade usually has some characteristic elements like using stone as the facade material, large wooden entry door with either bronze or iron door knobs, french double windows, dormer windows in the attic (occasionally with balconies), plain black ornamental wrought iron window grills, balconies (especially on the 2nd floor) (Hohenadel, 2022).

The ***heads*** of the Haussmann buildings are usually constructed with a grey zinc Mansard roof, where the roof is angled in 45 degrees in order to allow natural lighting on the street below (1,3). The iconical chimneys were originally used for heating, while today they maintain the iconic parisian rooftop expression.

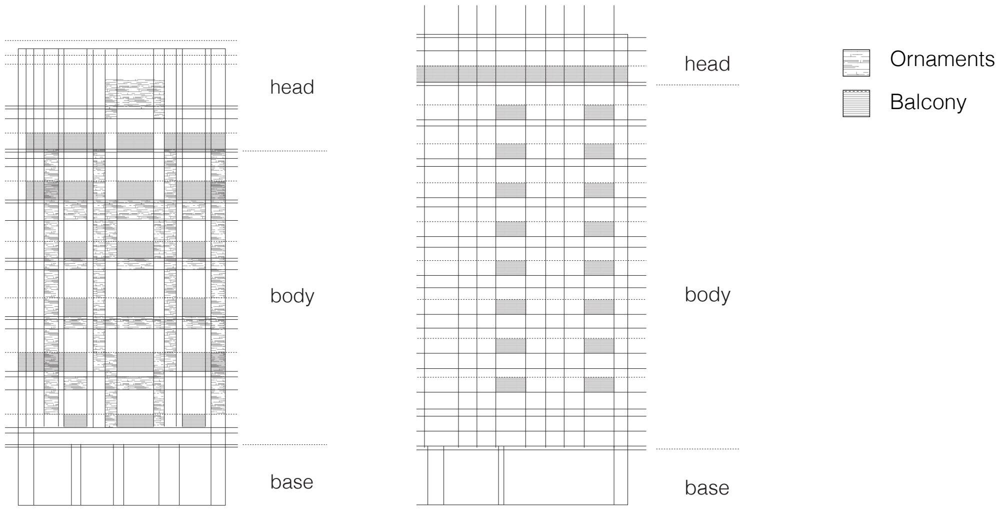
When observing the exterior from a street perspective the facades and the overall arrangement of elements seem dynamic and are a three dimensional experience(2). The sketches (Illu. 44) concentrates the first intuitions of the principle experienced on the study-trip. A glimpse of a desire to challenge the usual occupation of internal build structures in the ground floor is clear on the four presented sketches.

1

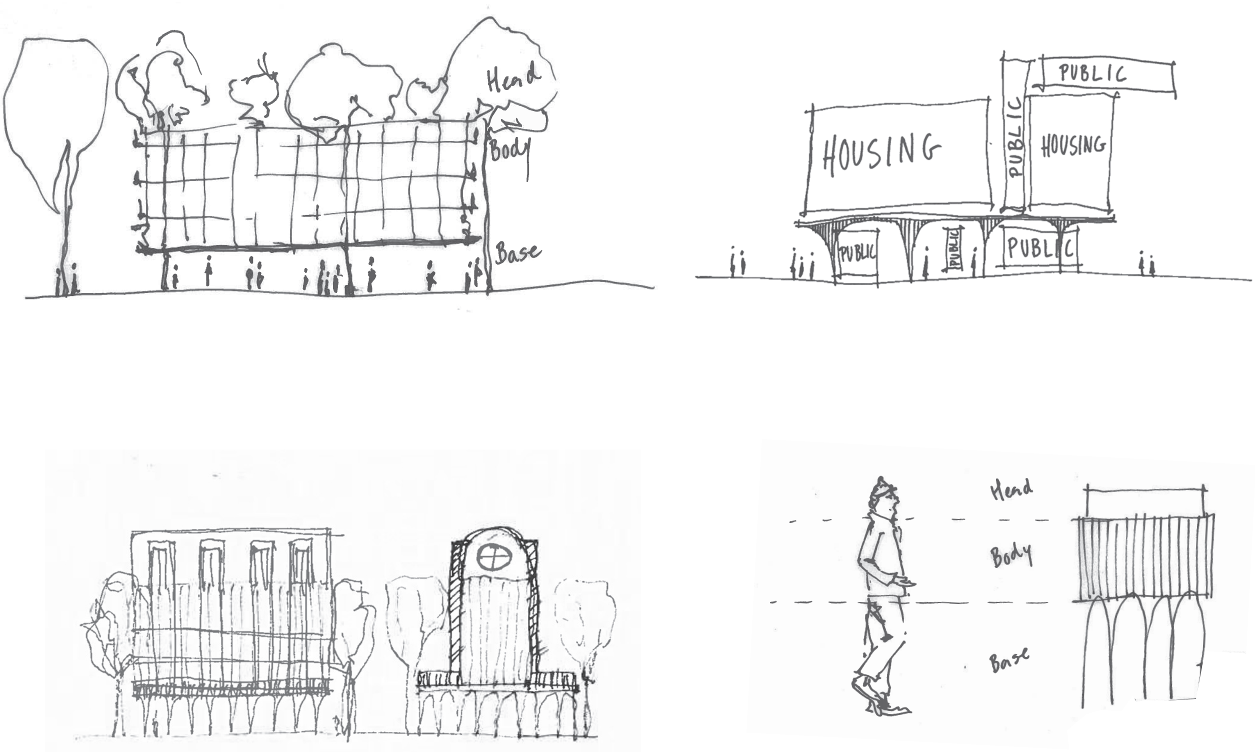
2

3

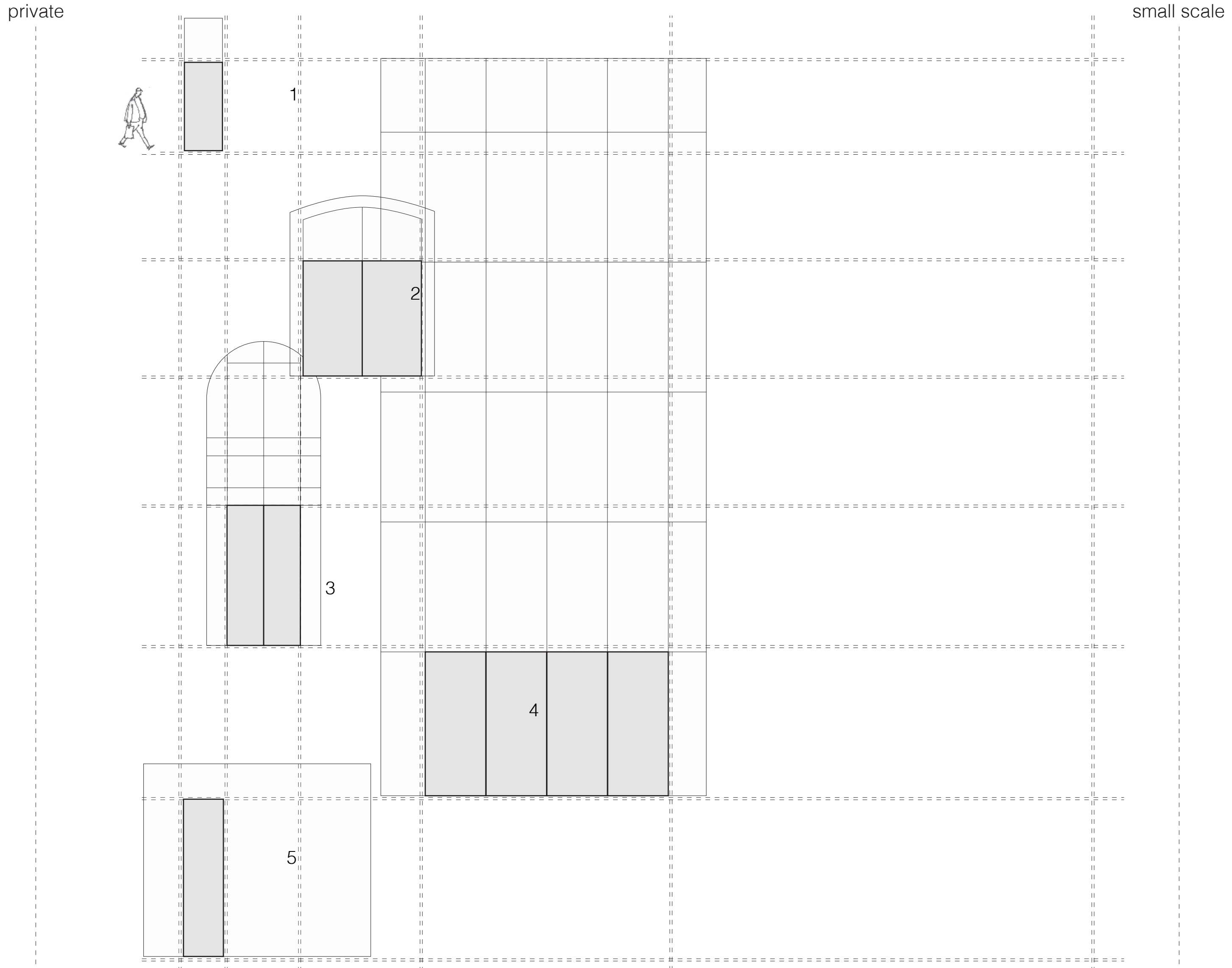
42. Haussmann buildings



43. Haussmann buildings analysis of layering



44. Sketches conducted on study trip, Paris – 20.02.2022-24.02.2022



Doors and openings

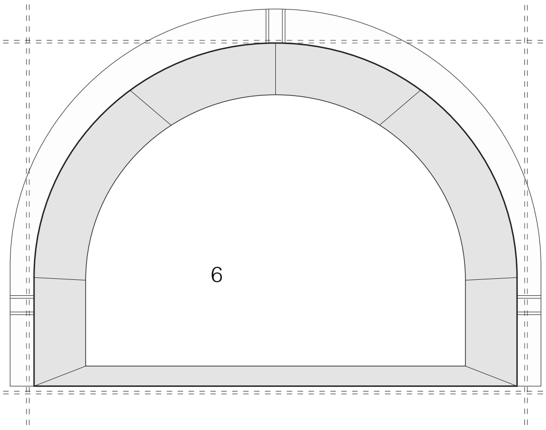
Objects enabling transition of subjects

Doors and openings are one of the selected elements of study to elaborate on the concept of the ***base*** of the city. A systematic investigation illustrates a close relation between semiotic categorizations of doors and their functional aspects. It has been possible to categorise the observed doors and openings in four; *residential, business, retail, and urban doors.*

The *semiotic, detailing, expression, materials and scale* are all elements that tell a story ranging from private to public. A range of different transitions in space. The doors become the objects, which enables a subject to transit from one space to another.

This investigation illustrates how the *base* with its doors gives a place its identity and characteristics. While the residential doors have a strong iconic and representative Parisian layer to it, a private transition, the urban *'doors'* affects one's curiosity and invites the passersby to explore the city, a public transition.

*The base of the building structures in the city becomes, indicated with a range of different types of doors and implicitly different kinds of transitions, the **verb** of the Collected Language, to which the **subject** (users in the street) reacts.*



45. Doors and openings

1

2

3

46. Residential doors

4

47. Business doors

5

48. Retail doors

6

49. Urban doors

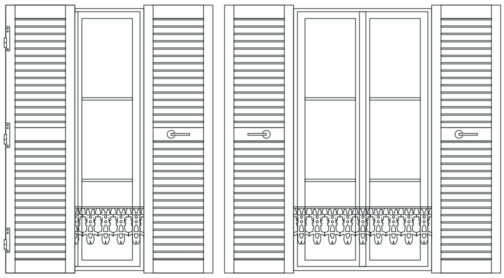
Windows and shutters

As part of the ***body*** the windows create the dominating rhythm of the architectural language.

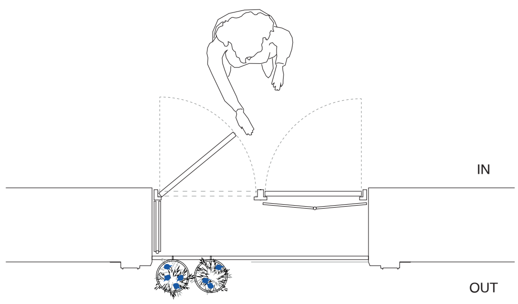
The window obtains many functions; *ventilation, illumination, solar gain, framing of the outside world, and a look inside from the outside observer*. Furthermore the window makes space, it asserts place-ness (Koolhaas, 2014, pp. 6-11).

"Windows, the operable kind, offer not just a view of the outside world but the possibility of contact with it, passively in terms of feeling a breeze and listening to the noise of the outside world, and actively in terms of shouting or tossing something down to the street, or just sticking your head out to take air. Since the 20th century and the growing preference of enormity or panorama, more and more windows provide a view of the world, and not a physical connection to it."
– Rem Koolhaas (Koolhaas, 2014 pp. 7)

The windows function both as a social layer, expressing the user's connection, or willingness to connect, to the outside world. Curtains and shutters create privacy as needed while also offering the possibility to experience different kinds of lighting and solar gain. Windows create the inconvenience of overheating during summer and creates a sustainability nightmare and uncomfortable indoor spaces (Koolhaas, 2014, p. 114). From studies of the parisian buildings it becomes clear that shutters is a well used solar shading, relating to ***behavioural opportunities*** for the user. In addition the elements have a great impact on the facade expression.



50. Parisian window shutters



51. Plan of Parisian window with shutters

Stationary heat balance:

$$\Phi_{sun} + \Phi_{internal\ gain} + \Phi_{heating} = + \Phi_{transmission} + \Phi_{ventilation}$$

Solar gain:

$$\Phi_{sun} = g \cdot f_{\beta} \cdot f_{shielding} \cdot f_{shade} \cdot f_{glass} \cdot A_{window} \cdot I_{sun}$$

g	= the g-value of the pane
f_{β}	= angle factor
$f_{shielding}$	= shielding factor
f_{shade}	= shading factor
f_{glass}	= glass part of window
A_{window}	= area of window [m²]
I_{sun}	= solar radiation [W/m²]

52. Shutters of Paris

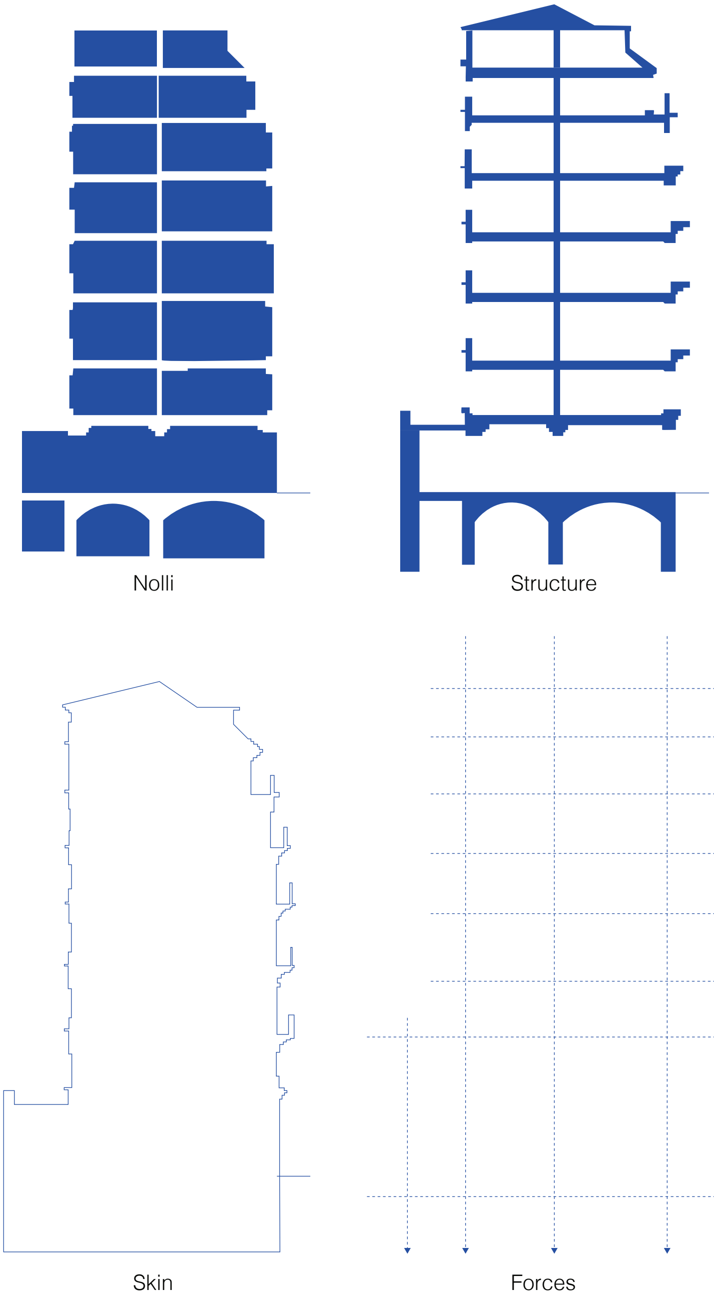
A structural level

On a conceptual level a traditional 19th-century Hausmann building is deconstructed into its general construction principles to examine the connections between the outer visible portrait of Paris' streets and the indoor spatial experiences. With a tectonic perspective focusing on the characteristics of the structural system in Haussmann buildings, the project has examined results form qualitative investigation of a haussmann building called *"Structural and material characterization of a Haussmann building"* (Cardoso, 2018) it is desired to understand the structural principles to foster inspiration in the developments of tectonic concepts in the project.

The *Nolli* illustrate the interior spatial geometry, whereas the *Structure* demonstrates the structural solutions and ground rules. The illustrations enhance an overall stringent spatial geometry and structure designed to contribute both as load bearing, the interior expression and the exterior expression. A playful twist appears both as a consequence of the mansard roof, the skin and the balconies and in the vaults with an arch-shape geometry.

The *Skin* and the *Structure* shows clearly with the continuous yet irregular facade the dominance of layering and detail, illustrating a dominant qualitative approach with no quantitative requirements setting boundaries. The 19th-century building has no energy related constraints and is designed to give both a playful interior architectural expression and exterior architectural expression. The project will focus on having a balanced qualitative and quantitative approach and experimenting how architectural quality can be applied on a structural/detailed level.

The project has developed an informal hypothesis;
if architectural quality is integrated on a structural/ detailed level it will give more freedom to integrate on architectural diversity on bigger scales. This will be elaborated on in the next chapter.



The facades facing outwards are constructed in dressed stone, the facade facing the backyard are made of timber or steel frames, the head of the building is constructed in timberframes (Cardoso, 2018, p. 349). The structural elements are aligned in vertical lines, which reveals the simplicity of a resistant structure in that period of time (Cardoso, 2018, p. 349). The structure is constructed in local materials (Cardoso, 2019), majority of all floor slabs, beams, interior walls and stairs made of timber (Cardoso, 2018, p. 349).

53. Haussmann structure

Challenging
Creating
Consolidating

How Place Mazas ACT, LIVE & BUILD

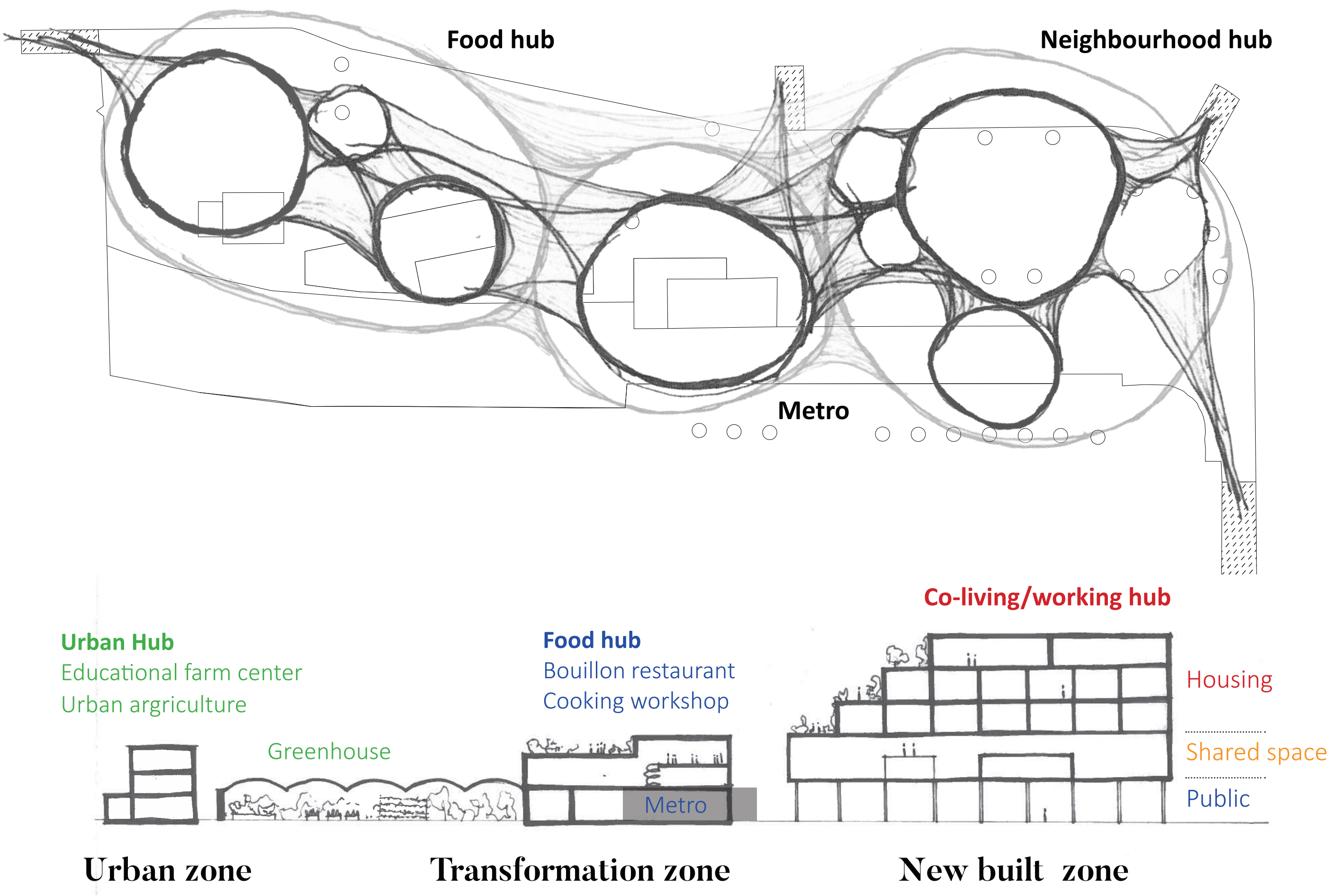
As described in the 'Methodology' (page 22-25), the process of creating this master's thesis has not been a cronologic experience with clearly divided phases. This chapter and the previous chapter VI; '*Studying, Investigating, Experiencing, How Place Mazas ACT, LIVE & BUILD',* have been inevitably connected. This chapter consists of crisual glimpse of an iterative and complex process, hence it should be read as a simplification of everything from intuitions, creative flows to concentrated and targeted workshops. To some degree the following paragraphs are chronology related, but this is not consistent.

Chapter VII

Delimitation

To create a greater understanding and ease the reading of this chapter a *functional diagram, room program* and *design principles* are presented. The creation of these has been a result of the entire process from the first sketch on site to the last detailed evaluations, but is displayed in this manner to create a greater overview and understanding of the project.

Functional diagram
Each function is chosen on the basis of the presented theoretical and analytical explorations, which is summed up in the chapter *'Typology and functions on site'* (page 46). They are chosen for their ability to to create a holistic site, where every part creates a greater whole. These functions will create a site of life, activity and opportunities, enhancing diversity on Place Mazas discussed in the chapter *'The hybrid mixed-use building'* (page 44).



53. Functional diagram, Conceptual ecology on site

Room program

	Quantity	Approximated m² (brutto)	Total approximated m² (brutto)	Privat/Public
Food hub				
Greenhouse	1	160	160	Semi public
Educational farm centre	1	-	-	Semi privat
Café	1	125	125	Public
Bar	1	16	16	Public
Grab and go	1	50	50	Public
Kitchen	2	44	88	Semi privat
Bouillon	1	300	300	Public
Storage	5	15,6	78	Semi privat
Toilets	6	3	18	-
Terrace	1	64	64	Public
RTD food centre (Office)	1	64	64	Privat
Technic	2	3	6	-
Neighbourhood hub				
Library niche	1	16	16	Semi public
Workstations	8	4	32	Semi public
Common workspace	1	42	42	Public
Teleworking	4	3	12	Semi privat
Commercial office	1	106	106	Semi privat
Meeting rooms	2	6	12	Semi privat
Open space	1	290	290	Semi public
Niche	1	16	16	Semi public
Common house	1	54	54	Semi public
Laundry room	1	30	30	Semi privat
Toilets	6	3,3	20	-
Technic	4	4	16	-
Apartment 1	8	34,5	276	Privat
Apartment 2	3	50	150	Privat
Apartment 3	2	67,5	135	Privat
Apartment 4	6	51	306	Privat
Apartment 5	2	52	104	Privat
Chamber	3	18	3 x 17-20	Privat
Common spaces	4	30	120	Semi privat
Terrace	4	30	120	Semi privat

54. Room program

Design principles

The presented design principles are the manifestations of crucial aspects fluently attached to the three *Design Layers; Urban, Architectural and Technical & Structural*. The principle is intentionally not categorized only to fit one of the Design Layers as it is in the *complex, chaotic* and *iterative* process of mixing and combining the interesting outputs it generated.

1. The site must be divided into an urban zone, transformation zone, and new build zone.

2. The architectural language of the project must be treated as an addition to the existing, not as a copy. The new buildings must be translations, comments or interpretations of the existing architectural situation, not copies. This concerns materials, construction principles and detailing.

3. The existing trees on the site must be preserved and well integrated as a part of the architectural expression.

4. The functions of the house must respond to the needs of the city by gathering functions and people who create a positive synergy, by ensuring different users at different times during the day.

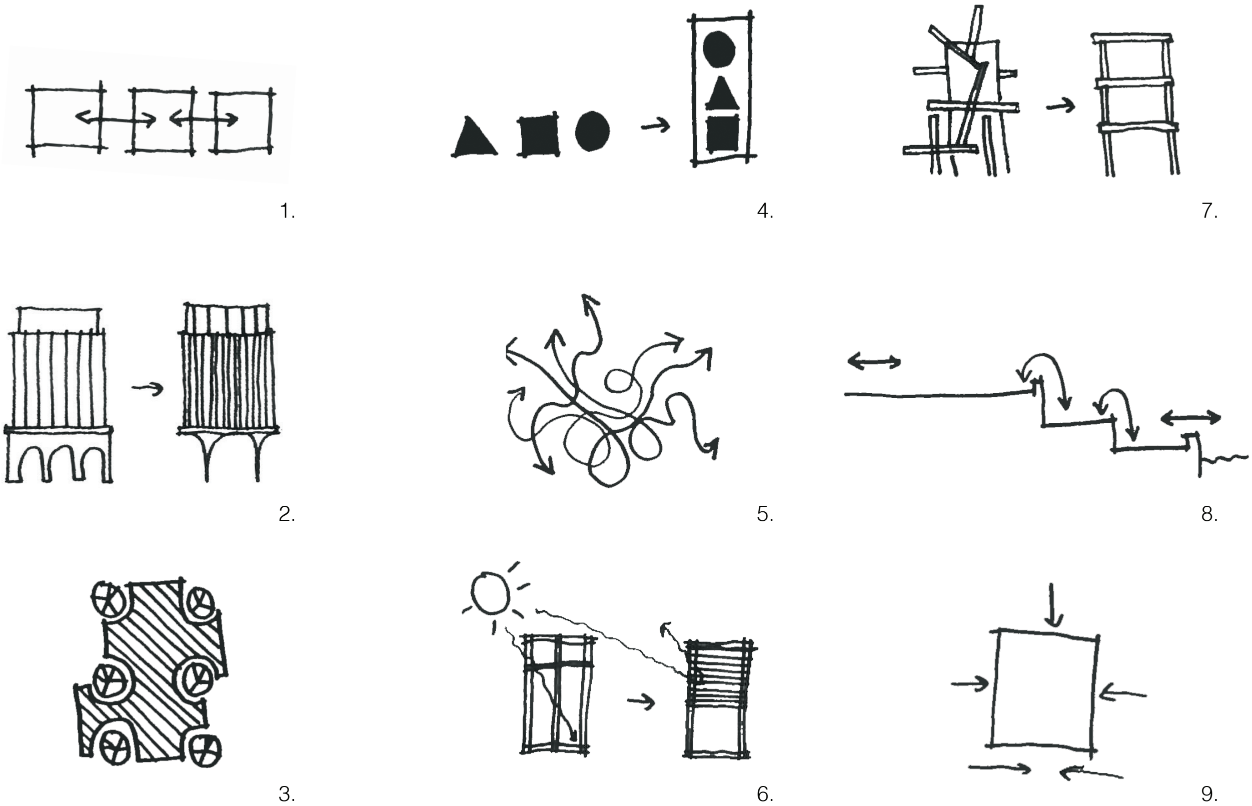
5. The new house must accommodate and benefit from the existing flow on the site created mainly by the metro station.

6. Indoor environments must be tackled through integrated means, e.g. exploiting the existing users behavioral opportunities of using shutters and manual solar shading to prevent overheating.

7. To minimize the complexity of transformation over time the architectural and constructional layer must be created as a whole that is easily construed.

8. The building must focus on transition in both urban and architectural space to ensure missing connections of the existing site. Especially the connection and utilization of the river Seine must be exploited.

9. To offer users attractive and comfortable outdoor areas during all seasons according to microclimatic conditions of wind, sun and noise the entirety of the building must be utilized; *under, between, besides and on top.*



55. Design principles

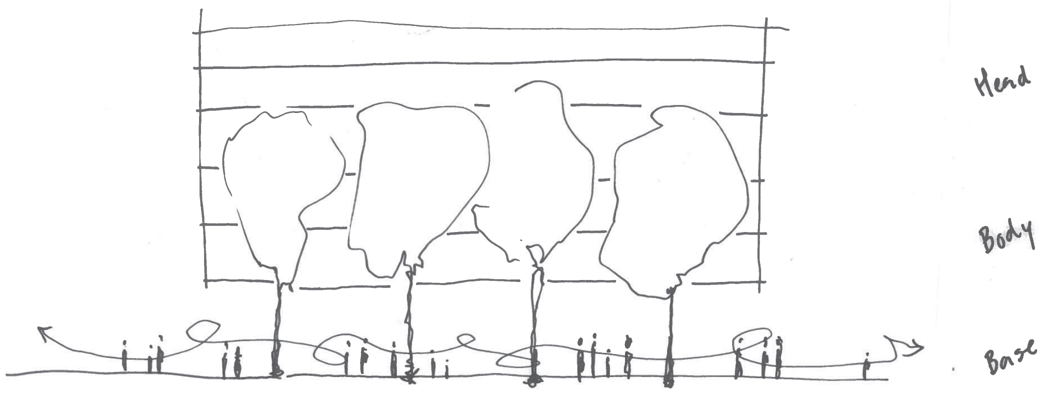
Concept sketches

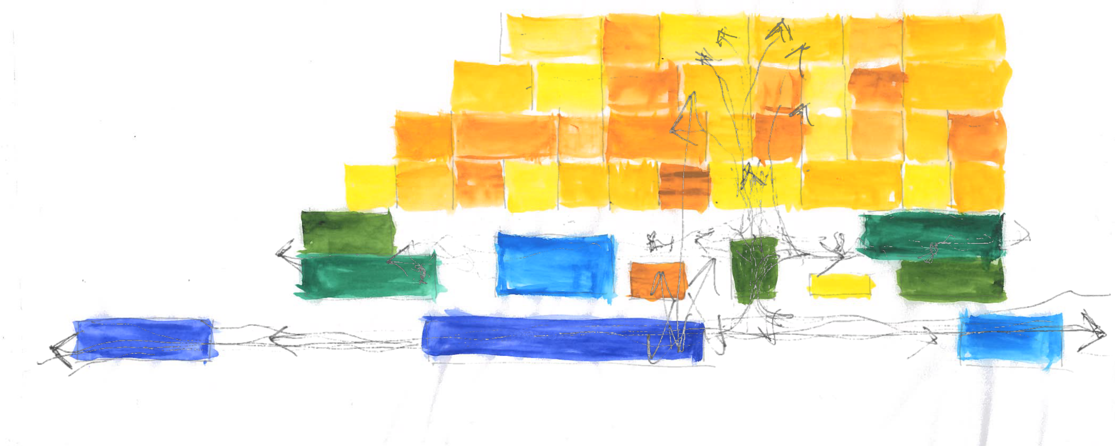
Concentrations of the reading of Place Mazas. Indication of challenges and potentials. Catalyst for evolutions and direction. A manifestation of intangible creative intuitions. A essential tool.

Spatial explorations through concept sketches. Major contextual elements as the existing trees on the site created a clear boundary for the project, while the narrow space between them became the creators of a gathered space. It seemed clear that the trees created the square and therefore must be part of the building that inhabits the square.

Arrangement through concept sketches. It became clear that the design was not to disturb the existing flow, but rather create space for the life of the city to happen in collaboration with the design proposal. As a result of the principle of head, body and base, and the flow on the site, an overload of concept sketches indicates raised buildings creating space for the flow underneath, hence the city as base.

Programming through concept sketches. To generate solutions for the programming of Place Mazas square. The different colors would indicate a difference in function type from public to private. The nuances could indicate variations. Is the green color a metaphor of the trees? Is the blue color a gesture to the waters and the sky?





Selected concept sketches

Intro to important contextual elements

The following paragraph deals with opportunities and challenges of three major contextual elements; ***trees(on-site), axis*** and ***building heights***. Elements to develop boundaries of volume studies to be further shaped and designed. In general, on a larger urban scale, the project wants to respect the existing surrounding structures. In addition, the project sees great potential to seek towards the river Seine and the wide prospects along with it. This led to the questions of: ***How to fit in? How would the building announce itself while creating a dialog with both a humane scale and the surrounding buildings? Should a new building place itself right in the visual impacts or should they enhance and support them?*** Studies through digital 3D studies, physical models and sections answered by evaluations raised questions.

Volume and building height
- in relation to context

Due to the vertical complexity in the near context, the verticality of a building on the site is important to understand. As natural vertical scale reduction exists, from the context buildings with a height of 26-28 meters to the river Seine, the question of either being a 'good' step in-between or the opposite arises. *Or being a step or not?*
Another aspect is the possibility to work actively with the *base-body-head* principles, as presented on page 74- 77. The trinity needs a certain vertical existence to be present.
This investigation of height is conducted in physical form models and rivisioned through sketching and analyzing the sections.

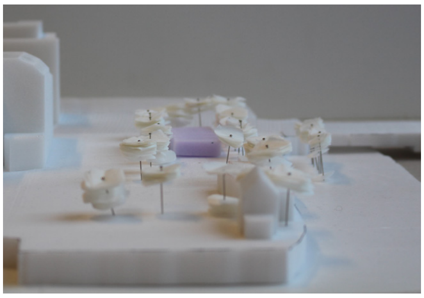
It is concluded that a height of approximately 18 meters creates a volume that responds to the opposite buildings and the river Seine while making it possible to actively work with the principle of *head-body-base.*

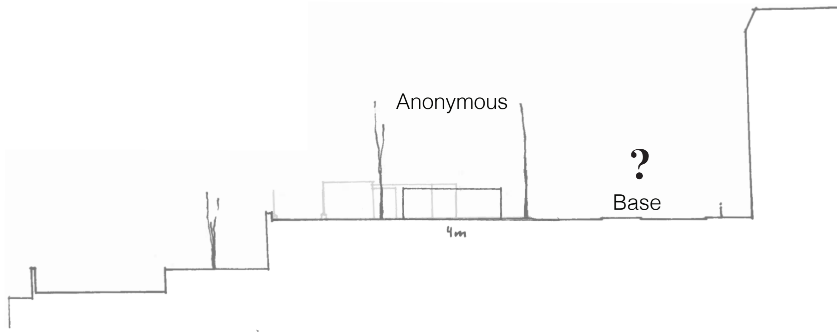
4 meters
- Radiate temporarity.
- Does not interact with the opposite standing buildings.
- Interacts with the buildings on the site.
- Anonymous in the city context.

8 meters
- Respects the existing context in relation to shadows.
- Interacts with the buildings on the site.
- The 'stepping down' towards the river Seine is manifested.

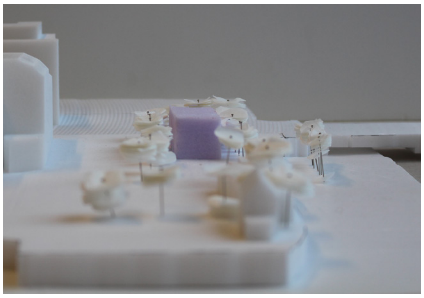
18 meters
- Great relation in height with a gradual reduction towards the river Seine and the existing buildings of the site.
- It becomes a cross of the anonymous and the boisterous.
- The concept of base, body and head can clearly be processed.
- Generates the potential of yet another 'step' towards the river Seine.

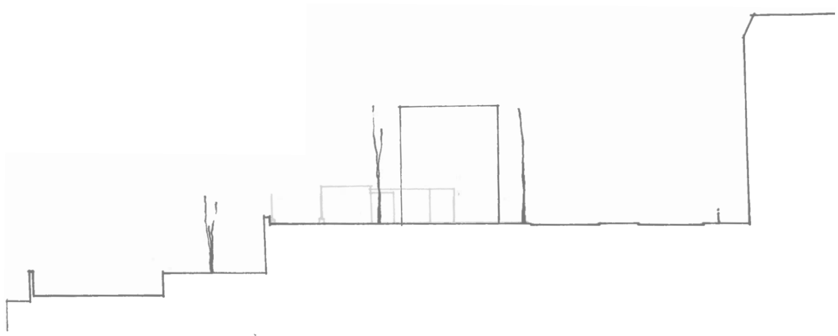
26 meters
- The space on the sides of the building are manifested as two spaces alike.
- May create challenging shadows for the context.
- Does not relate to the site. Becomes boisterous.
- Potential to become a landmark.



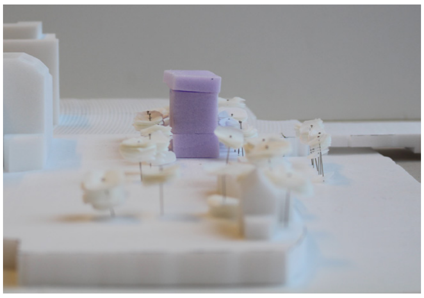


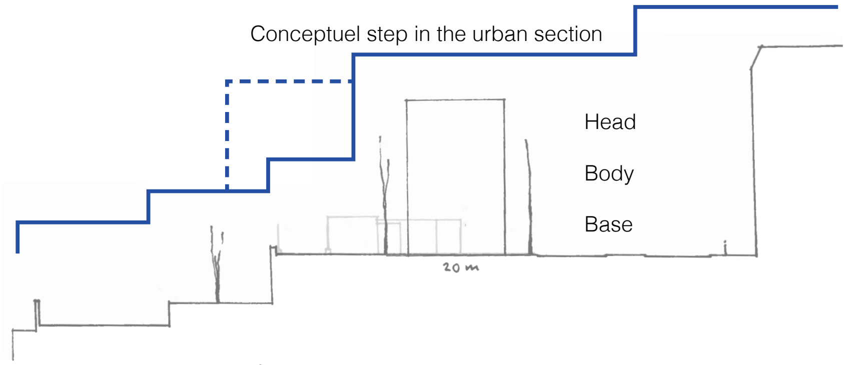
4 meters



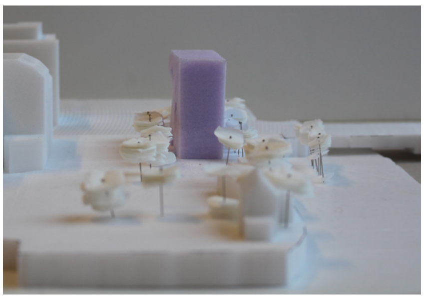


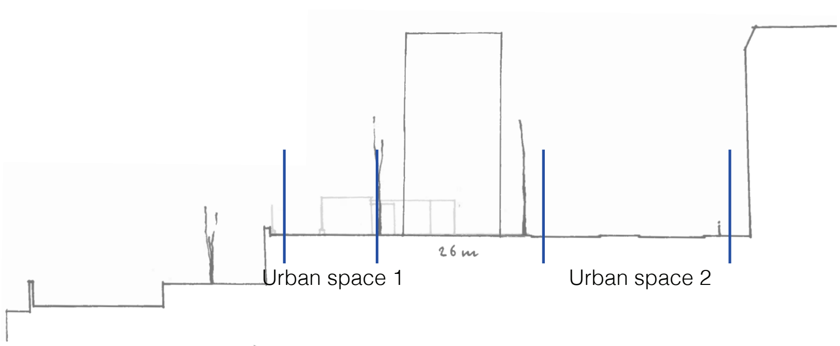
8 meters





18 meters





26 meters

56. Investigation of building hights

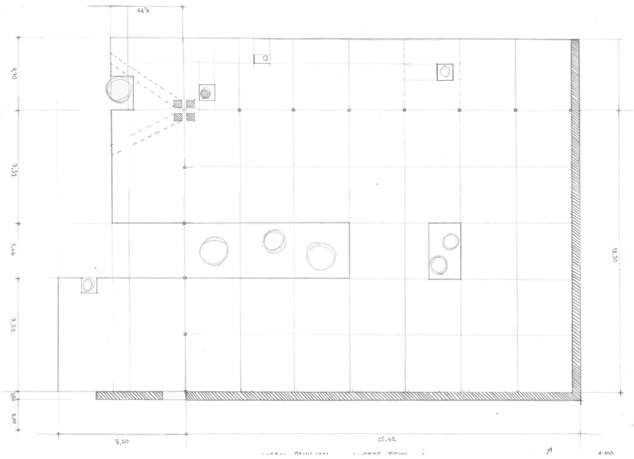
A case study of architecture revolving trees

As seen throughout the report, the existing trees on the site are of great delimitation and inspiration for the project. To create an understanding of how trees can be a revolving parameter in architecture two case studies were made. The cases work with different principles and approaches. Sverre Fehn's ***Nordic Pavilion*** is dominating horizontally, while Steven Holl's ***Winter Visual Arts Center*** is dominating vertically. The investigation is conducted by first sketching the original project/concept to understand and get familiar with it, and then transformed into/onto the site.

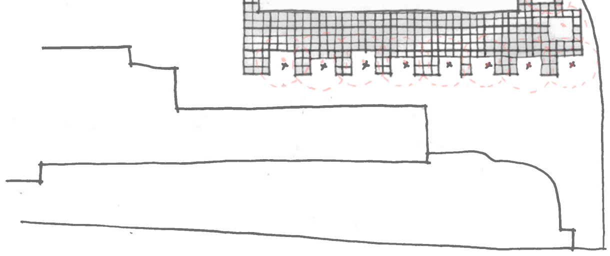
The two cases provided inspiration for the approach of working with the existing trees and not solutions.

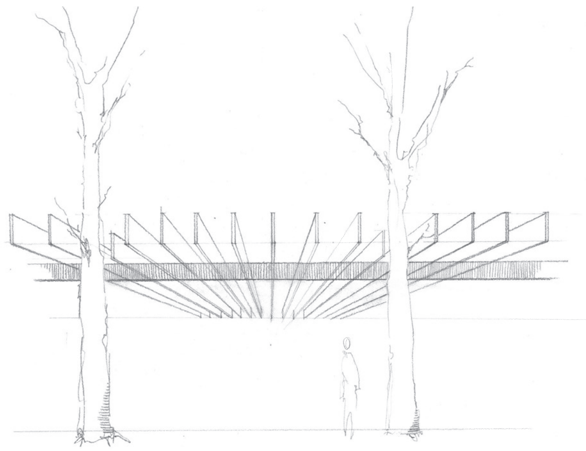
Horizontal
Nordic Pavillion
Architect: Sverre Fehn
Year: 1962

- The rigid grid correlates to the rigid planted trees on the site. However the rigid planted trees also lack the same hierarchy as is found in Nordic Pavilion.
- Encircle the trees and the square.
- Creates a strongly defined and rather big space underneath the trees.



57. Plan sketch of Nordic Pavilion

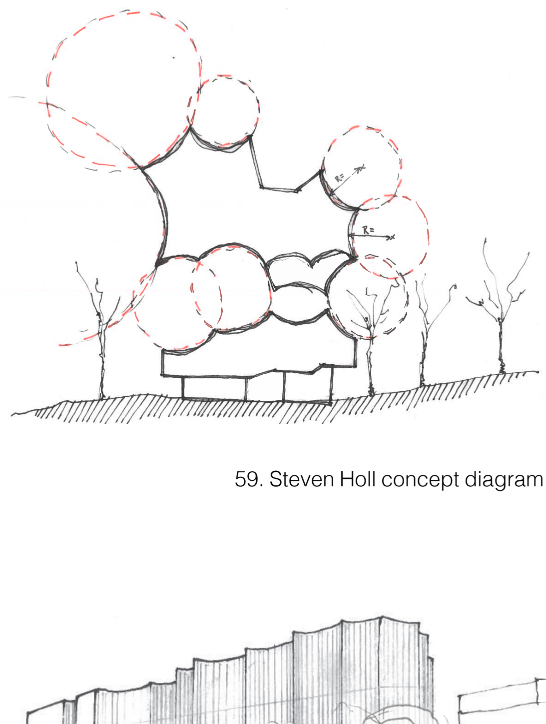




58. Principle of Nordic pavillion transformed onto site

Vertical
Winter visual arts center, Franklin & Marshall college
Architect: Steven Holl
Year: 2020

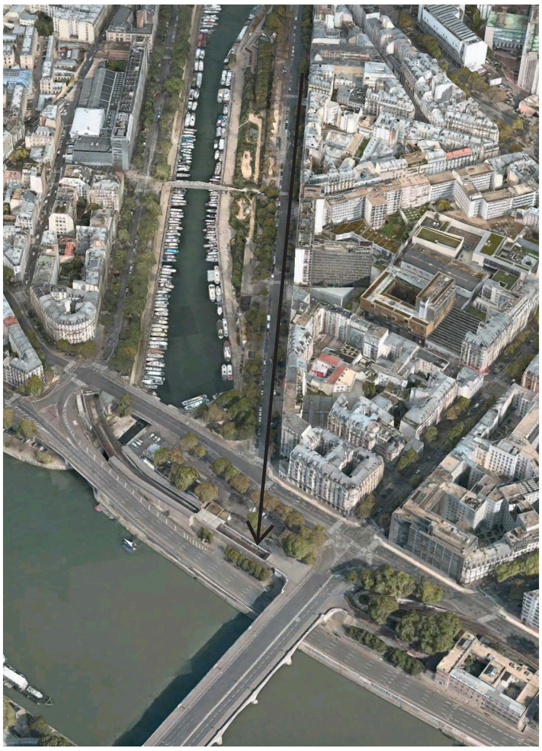
- This concept becomes the 'negative' shape of the trees.
- The 1:1 space between the treetop becomes a building
- Due to the significant shape of the building volume it demands an extreme simplicity of other architectural elements to be portrayed in all its power.



59. Steven Holl concept diagram

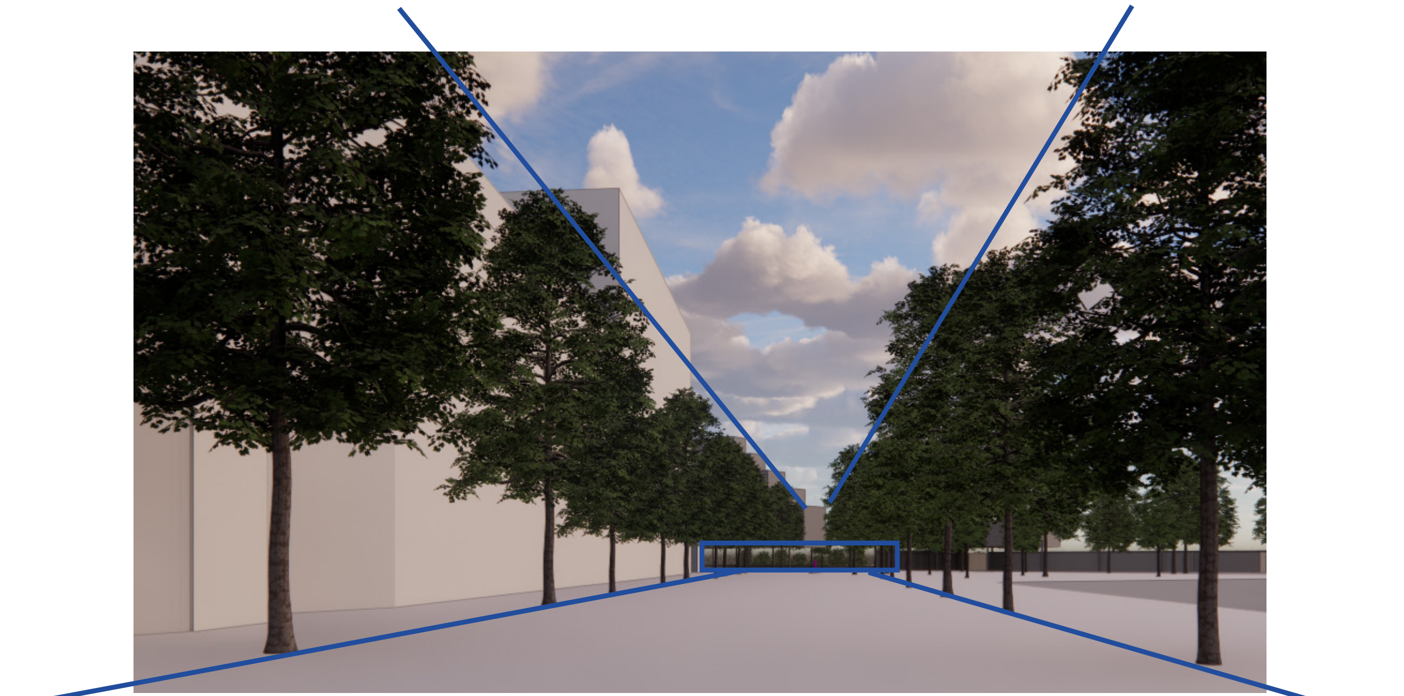
60. Principle of Steven Holl transformed onto site

Visual conditions and connections

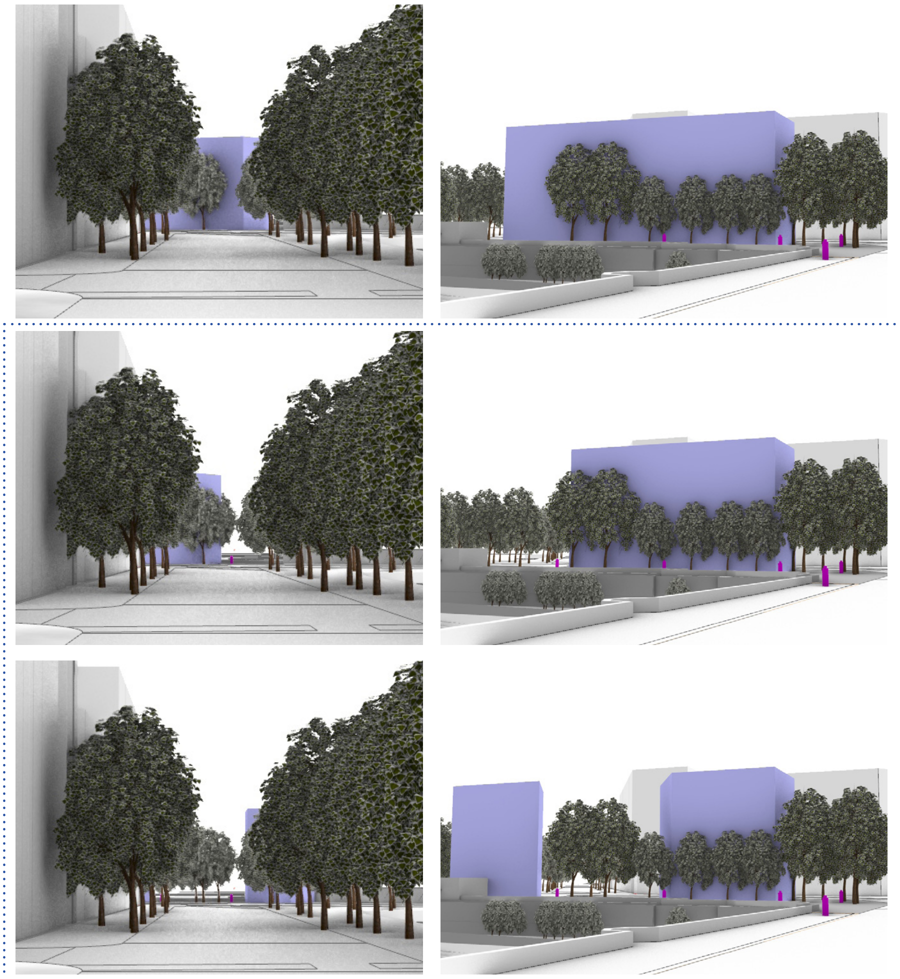


61. Haussmann axis seen from above, Boulevard de la Bastille

62. Haussmann axis seen from the ground, Boulevard de la Bastille



63. Haussmann axis highlighted



One long building
No vertical scale reduction towards the site is created
The metro entrance is totally blocked

One shorter building
'Space' between building and metro is assessed as a quality, maybe because of a certain 'harmony'

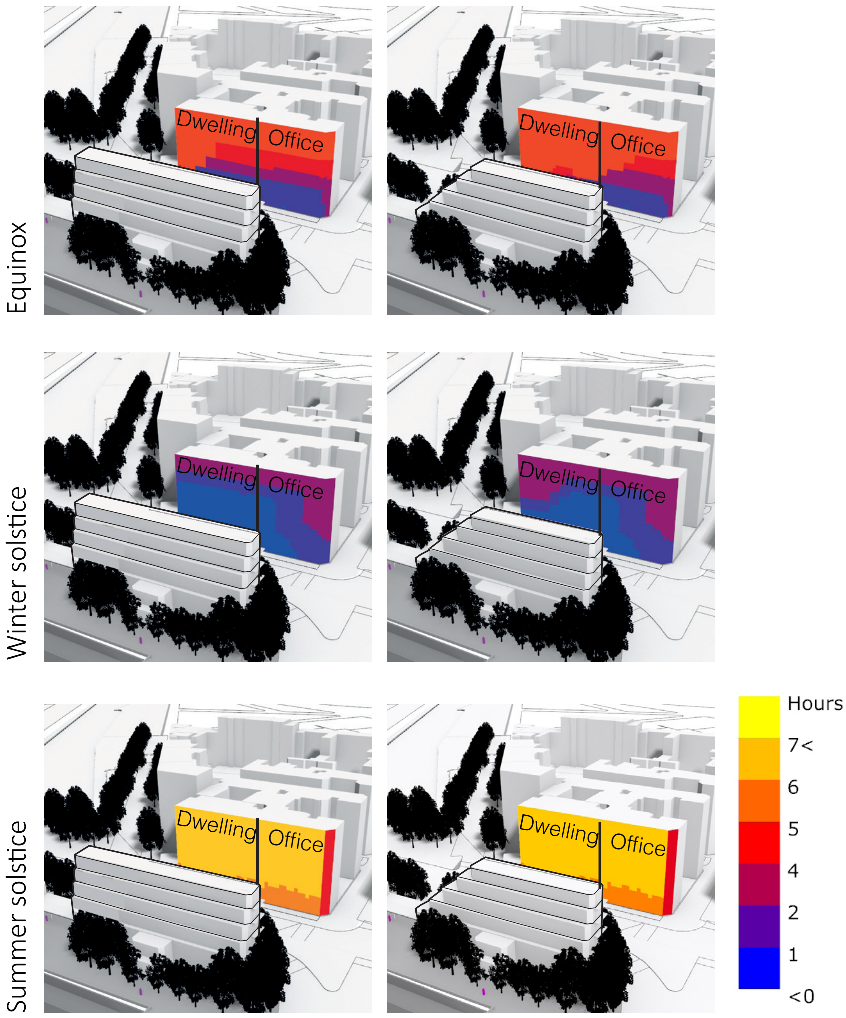
Two cut buildings
An interesting space between the buildings is created.
The axis is enhanced
Framing an 'urban gate'. Does something need to happen at the end?

64. Investigations of buildings on site in response to the Haussmann axis

Parallel with the previous contextual aspects of trees and building heights the visual conditions and connections have been investigated in different scales, using different approaches from quantitative simulations to qualitative assessments.
The following illustrations with additional comments show the loops between iterations. 'One long building' was immediately eliminated, whereas the two other solutions both had potential for further investigations as they related to the following considerations of the axis.

Does a Haussmann axis matter?
The axis is enhanced by rows of dominant trees along the road and pathway on Boulevard de la Bastille (Illu. 61-63). ***Why is THIS axis important?***

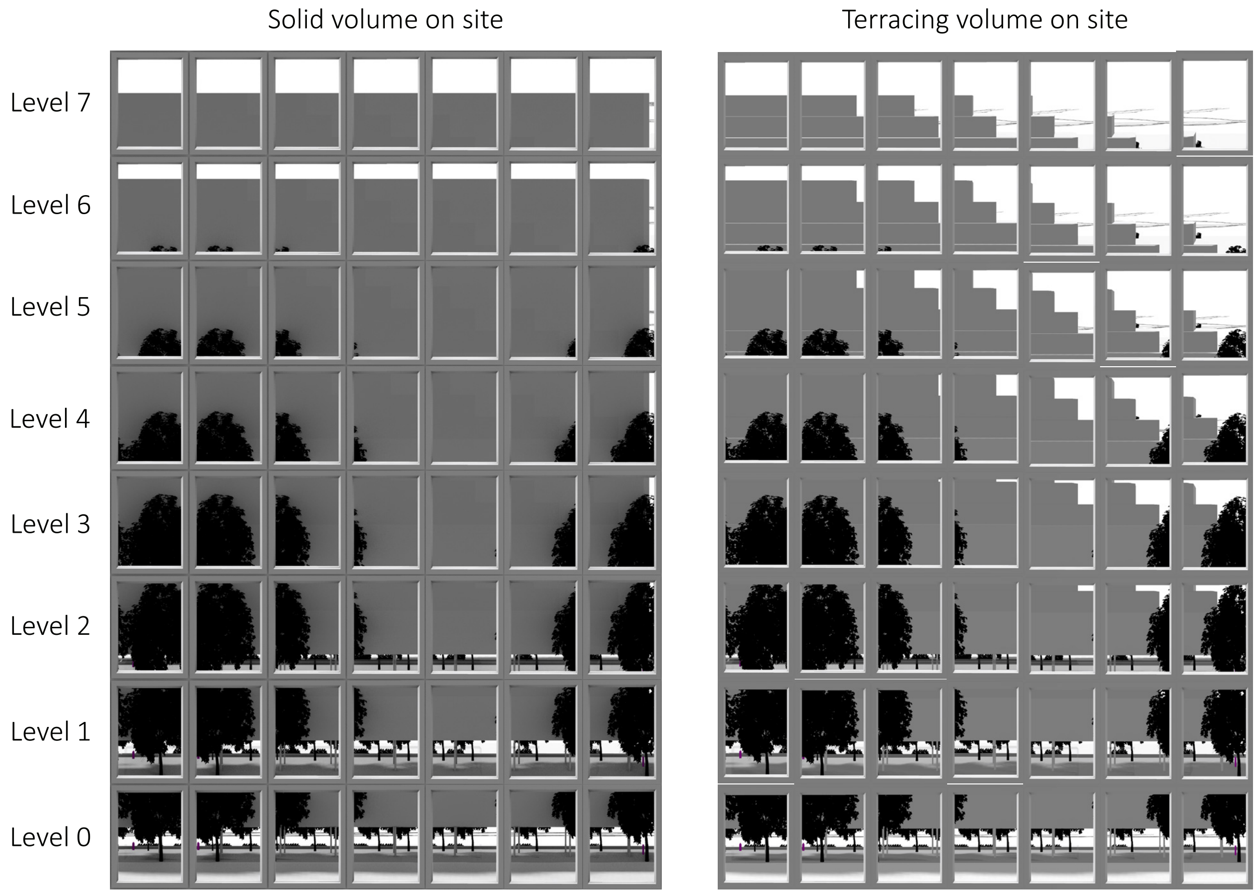
- It 'ends' very directly in the site
- It is a 'green' axis ending in a 'green' square and indirectly in the Seine
- Axis in plan: extremely defining urban element, frames the city, gives the city its identity and functions as navigation and orientation in a dense city (Illu. 61).
- It could be thought of as the laws of urban townscape. Do you mess with the law?



65. Investigation of daylight condisions on oppersite building caused by volume on site

How do we affect the daylight for the opposite building?

As a continuation of the visual conditions, quantitative simulations of daylight conditions on the opposite building have been conducted and assessed using daylight hours. It is a wish to examine how the building created on our site affects the context, while it is a wish to sustain certain qualities for the contectand in this way be socially-sustainable. The analysis has been performed using Grasshopper to Rhino, for all hours between 15-21 as the target point is the upper left part of the context building with dwellings. For the other part of the building, the offices, it is assessed to be a quality to block the sun during the cooling season. It is clear to see that a building with a scale reduction towards west and the rest of the site increase the conditions on the neighboring buildings facade.

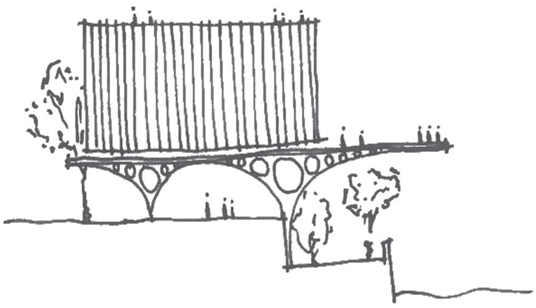


66. Investigation of visual conditions from the opposite building towards the site

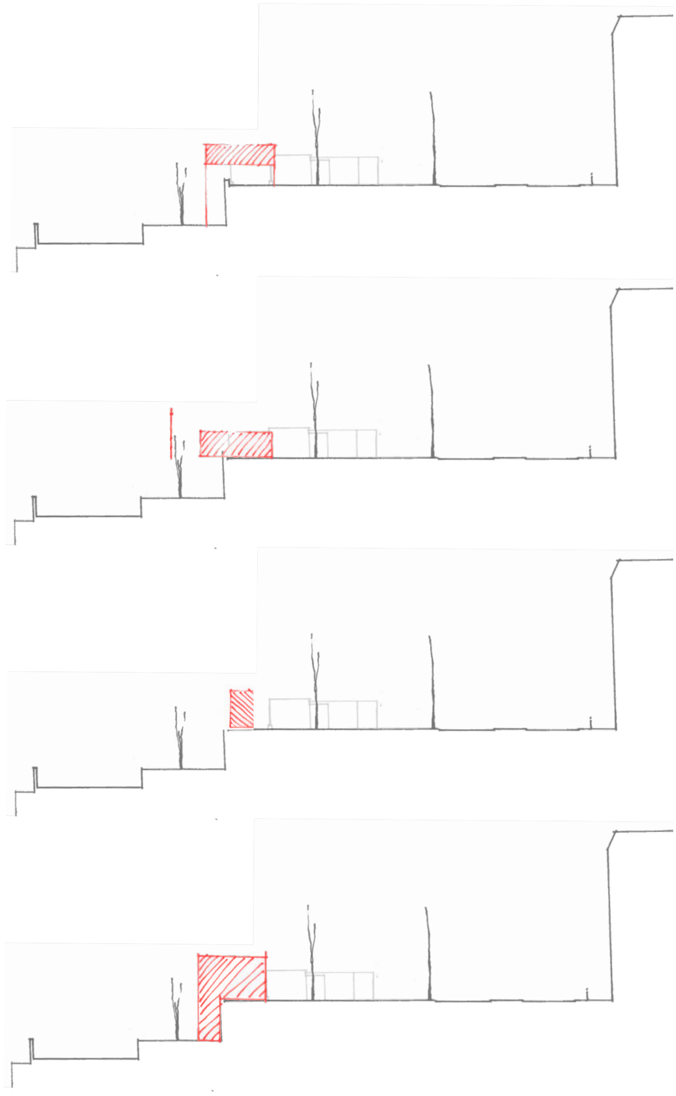
How do we affect the view for the opposite building?

To support the quantitative investigation, a rather abstract and fluent qualitative view-investigation from inside and out towards the river seen from the opposite building has been conducted. The view-point from which the 'scenes' has been taken is approx. two meters inside the opposite building looking out through the windows towards the site. The investigations are mode for one solit volume on the site and a terracing volume. The results indicate that the qualities of a view from the opposite building is to some extent ensured by using the terracing building.

Meeting the river Seine



67. Concept sketch of meeting the river Seine

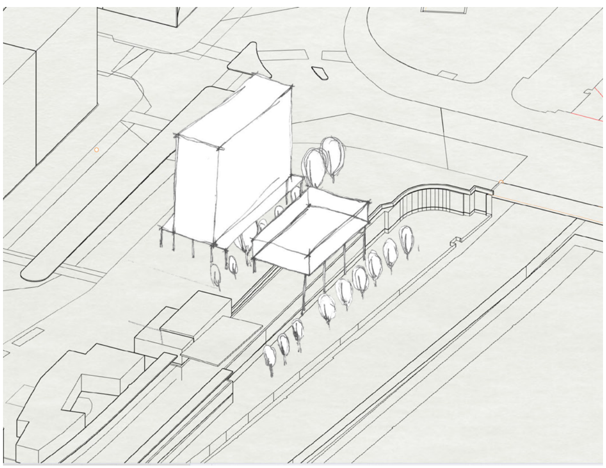


68. Section investigations

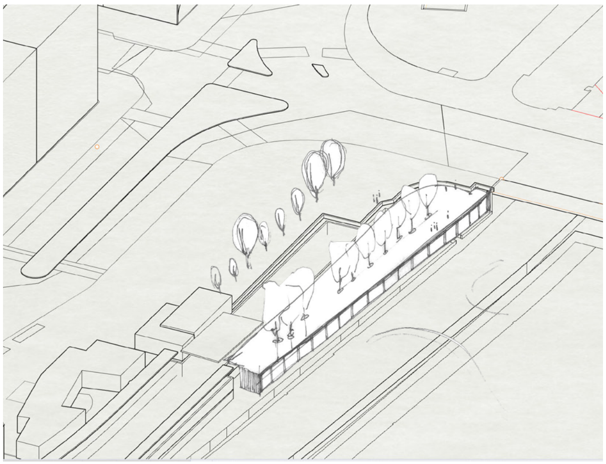
As a result of analyzing the site (pp. 34-35) it became clear that there was a missing link between the site and the river Seine. An investigation of how to restore this missing link and reconnect the city with the river was conducted.

In an attempt to reconnect the site and the river using a building volume, it seemed necessary to build on top of the metro tracks as seen on illustration 69,71,73 and 74. Although this was first seen as the right solution, it became clear that a building on the metro tracks would actually create an even bigger barrier between the site and the river, both visually and physically, than already existing. The coherence of the entire site also became weaker due to the fact that a totally new build area was created on the south-eastern part of the site, away from the existing buildings, instead of merging the existing with the new. Due to the visual and physical barrier towards the river that appears when using a building volume, it became clear that the physical connection had to exist in an urban strategy as seen on illustration 70 and 72.

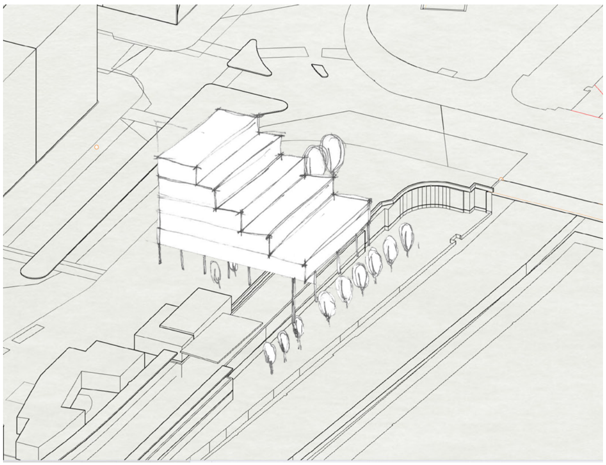
Although the investigation revolved around the building volume and site in the meeting with the river, the facade on illustration 74 became an element that was found interesting, both concerning the creation of attractive outdoor spaces for users and residents of the building, and due to the creation of a human scale in the urban spaces between the buildings. The facade also interpreted the parisian facades as described on page 72-77. The facade and its volume created a direction and gradual reduction towards the river, which in all its simplicity and tactfulness was an interesting approach to the subject.



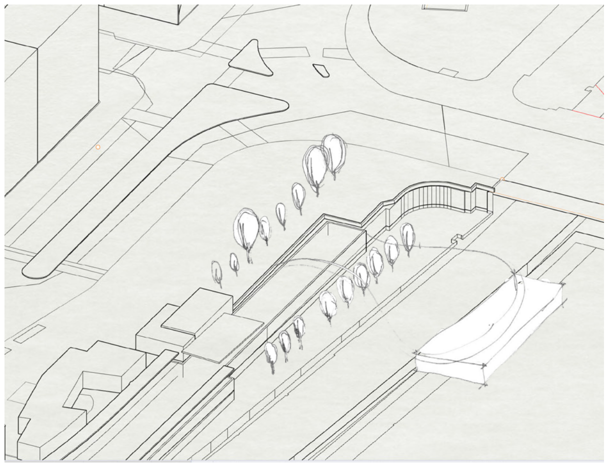
69. Two buildings, which together are stepping down towards the river.



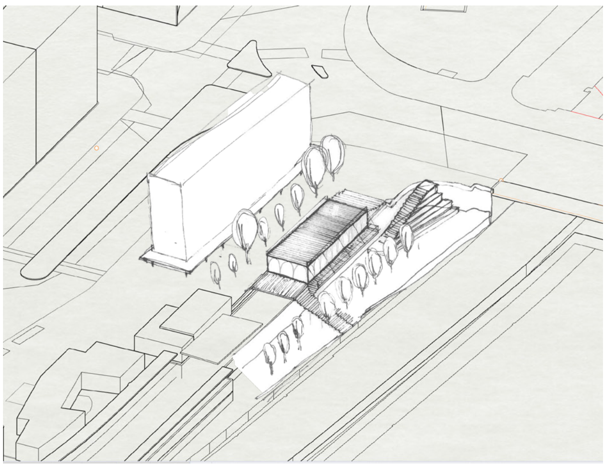
70. Filling a step out with volume to smoothen the vertical differences out.



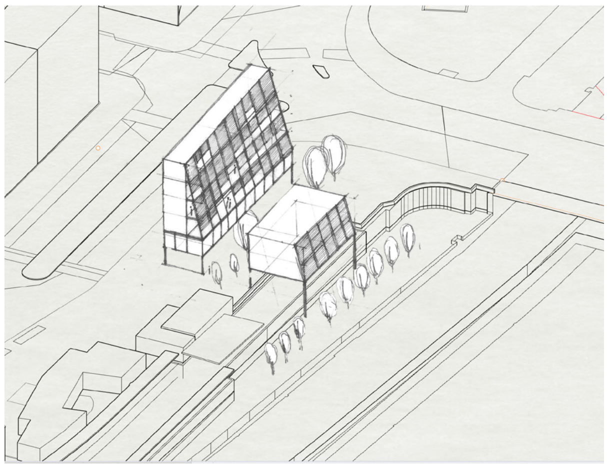
71. One building became a staircase with steps towards the river. The concept of this, mixed with illustration 74, could together create a concept of *stepping down* into the river.



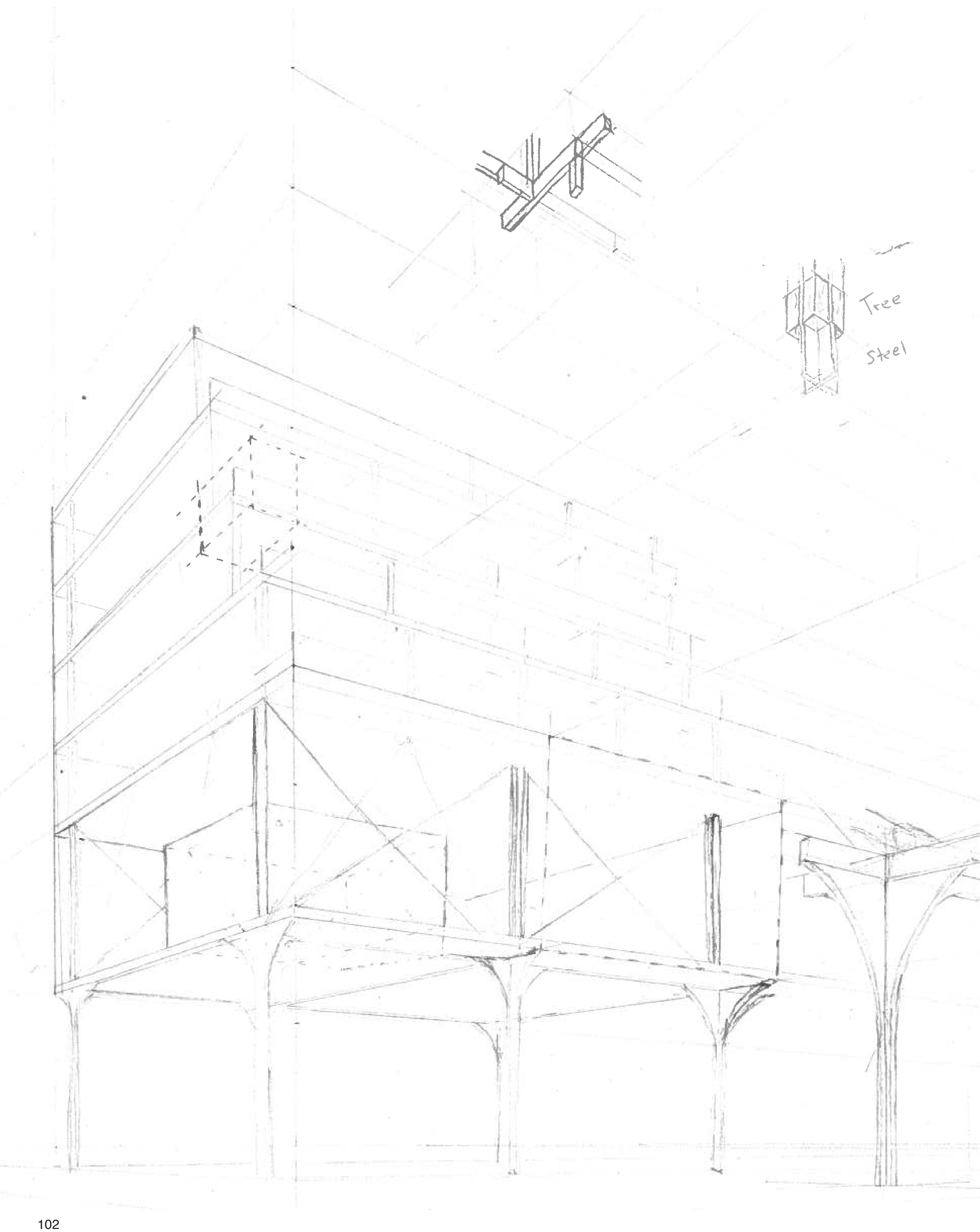
72. A new *step* in the river. This could be interesting in the urban-scale masterplan for the near area.



73. A building on top of the metro tracks creating a closer connection to the river and using the energy from the metro.



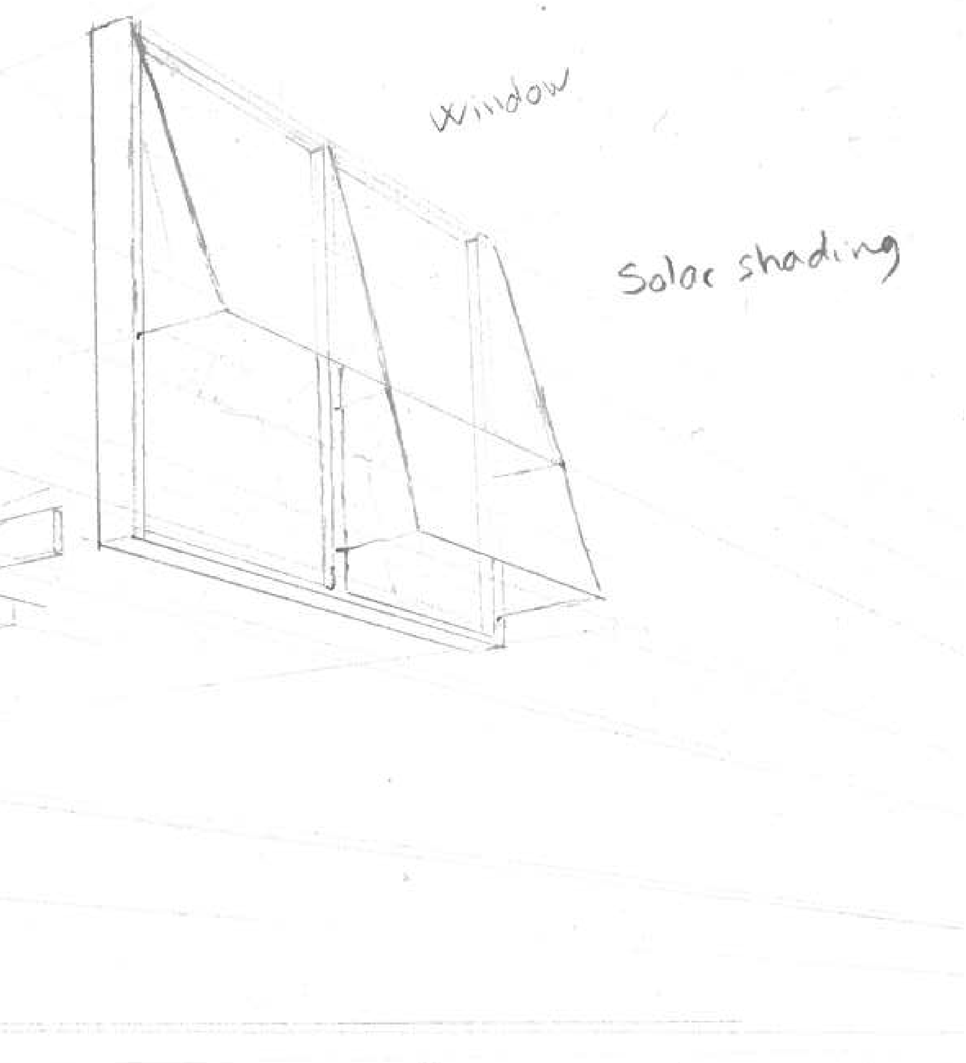
74. A building raised over the metro tracks with a facade showing the direction towards the river and the human scale.


Tree
Steel

The *Base*
- A raised building and the space underneath it

Today an urban space/square is created under and between the trees but is not utilized or exploited in any way. The analyses of the site revealed the importance of ***people in motion*** and the trees in relation to the ***head-body-base principle***, therefore it became clear that the ground floor of the building needed to be carefully developed. Based on the three mentioned primary aspects the following tectonic approach is defined:

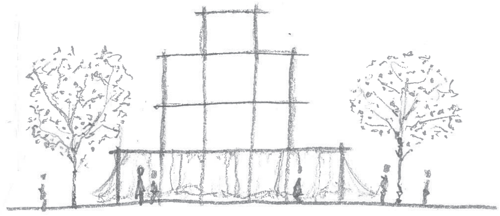
How can the materiality, form and arrangement of structural elements create a building that seems to be hovering above the everyday people in motion on the ground floor and simultaneously intensify the space created by the trees?

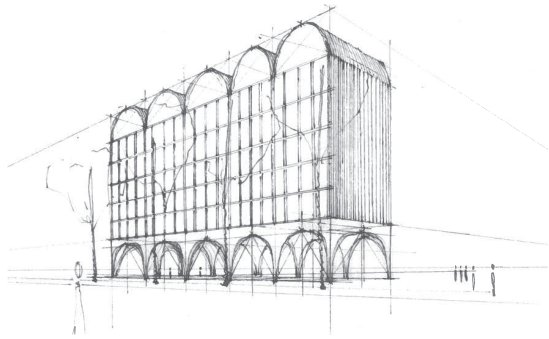


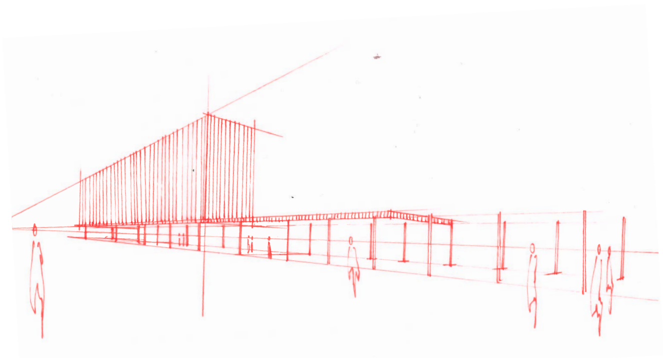
75. A tectonic sketch

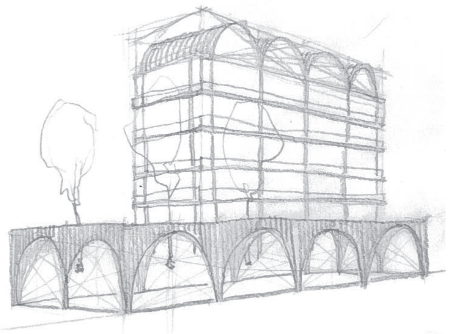
Sketching tectonics

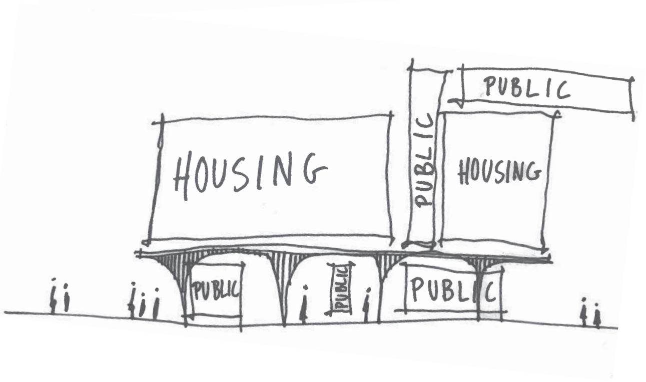
As a part of the observations, investigations and analyses made on the study trip to Place Mazas in Paris, hand sketching was deliberately a focus. Through sketching the reading of the site was explored and initial design investigations created. The investigation of the ground floor was thoroughly investigated through handskething.
This collection of conceptual sketches regarding the aspects of lifting the building from the ground illustrates different ideas of how the columns used to raise the building could either create space open up to the surrounding city.

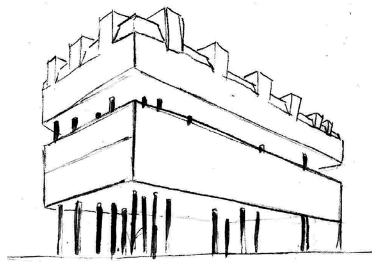


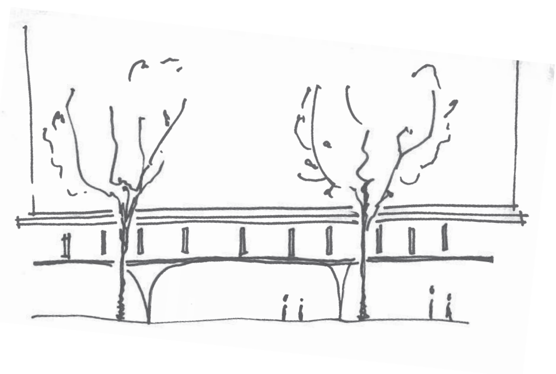


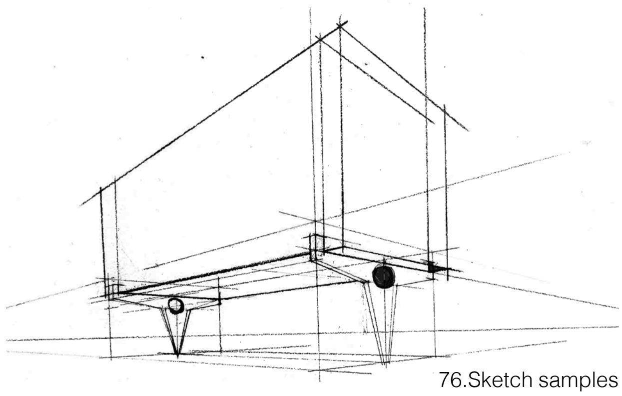






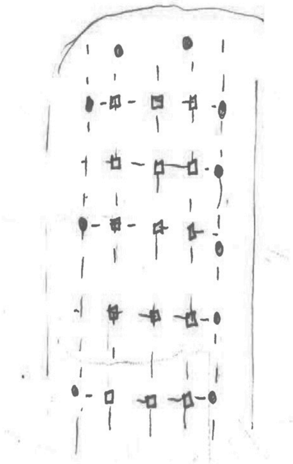




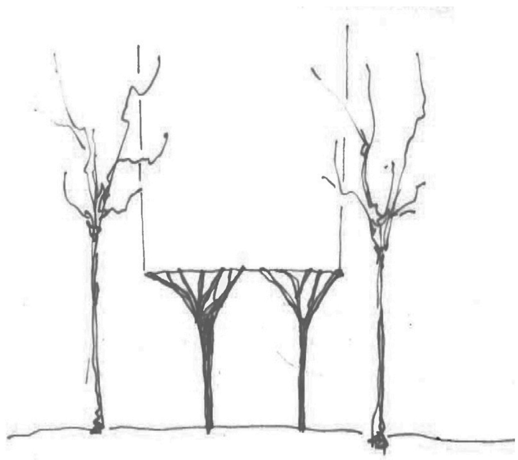


76.Sketch samples

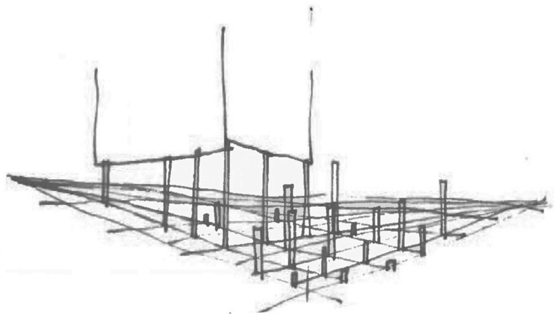
What is the story of the columns?
During investigations and analyses of the site, in chapter II and VI, it became clear that the flow of the site was important and could create a concept for the project. This importance of creating a concept for the ground floor generated the question of the role of the columns. A combination of illustration 77 and 78 has been further investigated as it is assessed as the most suitable narratives to enhance the already existing space between and under the trees.



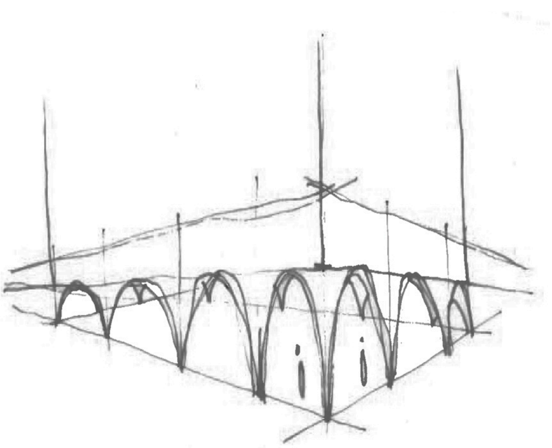
80. The columns creating a grid and a system



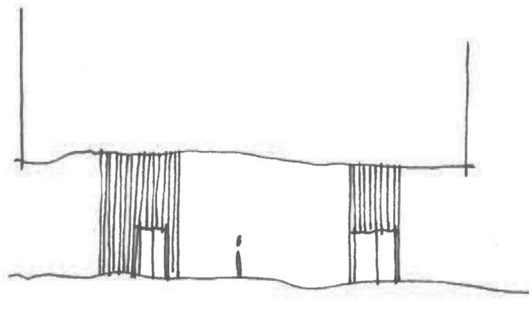
77. The coulumns mimicing trees



81. The columns inviting to activities



78. The columns creating spaces

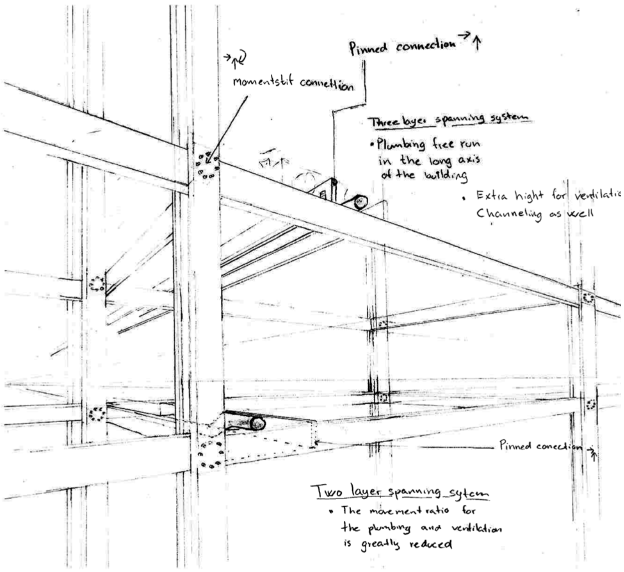


79. The columns as part of a solid building volume

Unfolding the column

Spanning systems

This analysis is performed in order to expand the project's structural knowledge and vocabularium regarding structural systems in the search for a structural system to create an open and light expression. Different types of one way systems are investigated and evaluated due to patterns and qualitative expressions of the different types. One way systems generally have three different spanning systems. One-level spanning systems, two level spanning systems and three level spanning systems (Schodek, 2004).



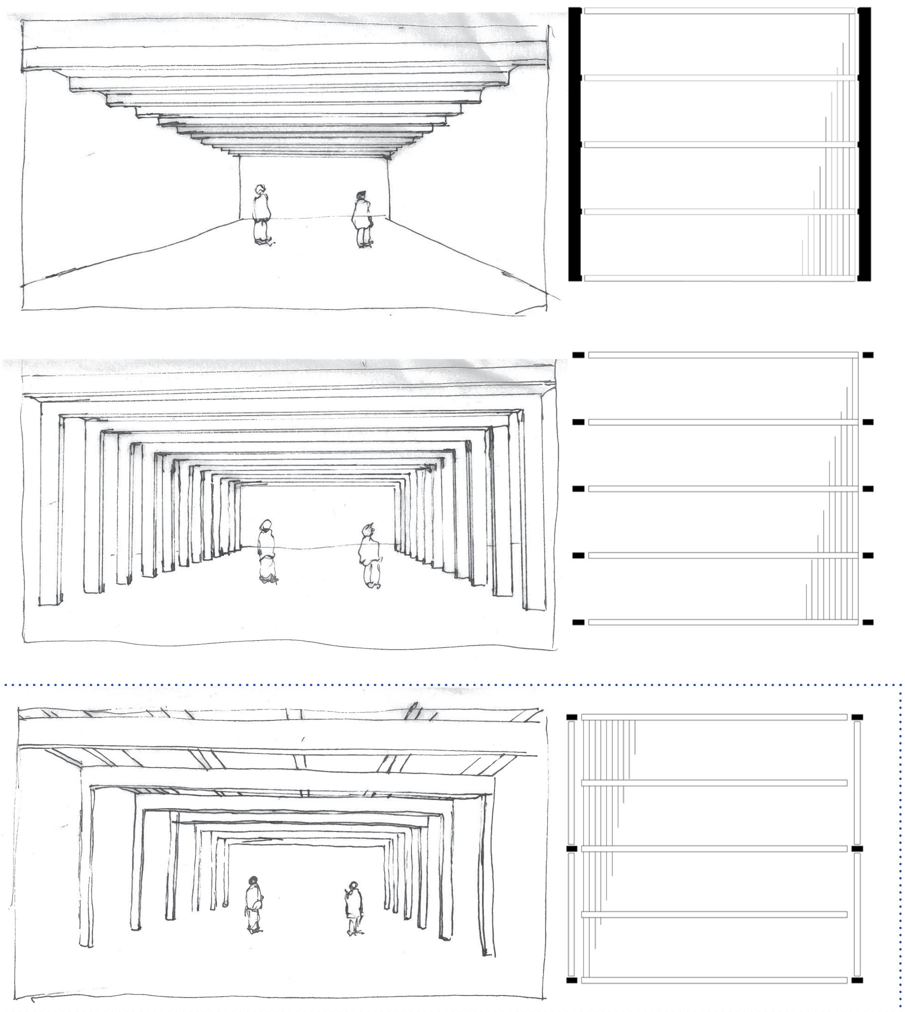
82. Piping through three level system

It is concluded that the three level spanning system creates interesting possibilities of working with a light and floating building and is used for further work.

One level spanning system
This system is almost enclosed and creates a tunnel with horizontal elements in the ceiling/roof. There are small openings in between the horizontal beams.

Two level spanning system
The columns create an open space and let natural light penetrate the area. The columns and the beams create a frame that continues from start to end. The distance between the columns is small and can, from the wrong angle, be experienced as a closed wall.

Three level spanning system
The distance between the columns is larger compared to the one-layer and two-layer spanning system. This gives an open and light expression. The load bearing and the stabilizing beams layered on top of each other gives a light expression. The three layer spanning system also opens up for the possibility to place unobstructed piping and installations (Illu.83).

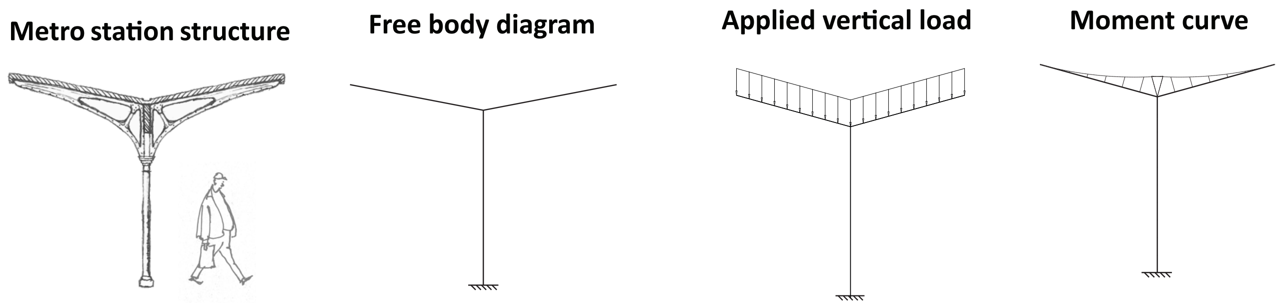


83. Spanning systems

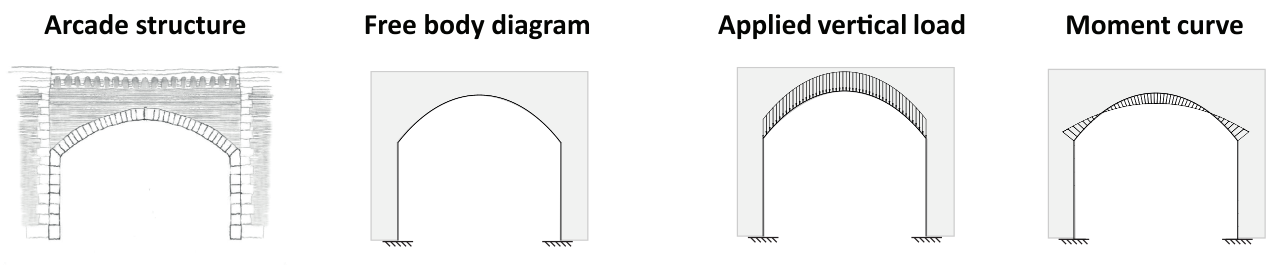
Understanding the contextual structures

This investigation is performed in order to give a structural insight on structures located on and in the near context of the site. This is done by sketching the structure from the metro station (Illu 84), an arcade(Illu. 85) and Pont de Bir-Hakeim (Illu. 86), and creating their free body diagram and investigating the moment forces. The project has in this case actively chosen not to investigate the normal and shear forces.

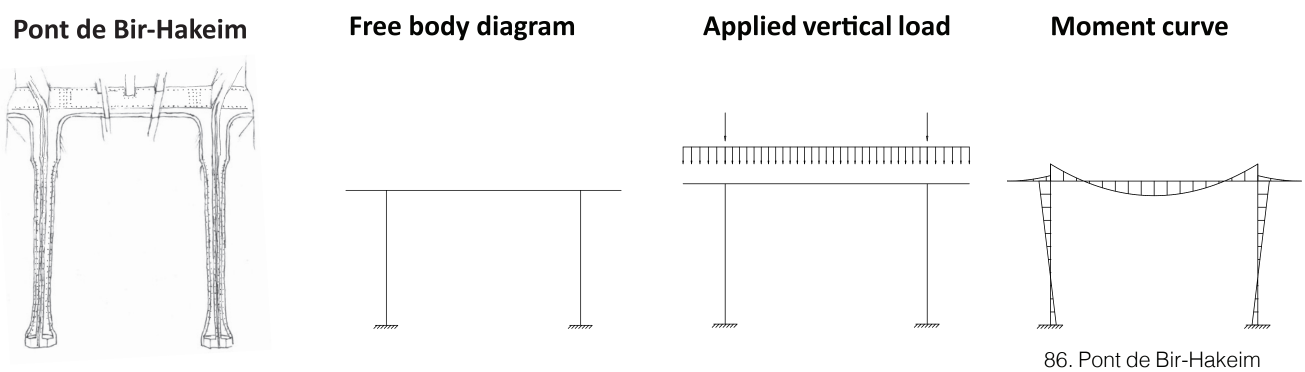
The cases have led to an understanding of the arch as an important element in the visual expression of old parisian structures which are all created by a consequence of the moment forces. They all tell a story of internal forces and full use of materials.
The Pont de Bir-Hakeimhas (Illu. 86) has especially functioned as inspiration for later work.



84. Metro station structure



85. Archade structure



86. Pont de Bir-Hakeim

The arch

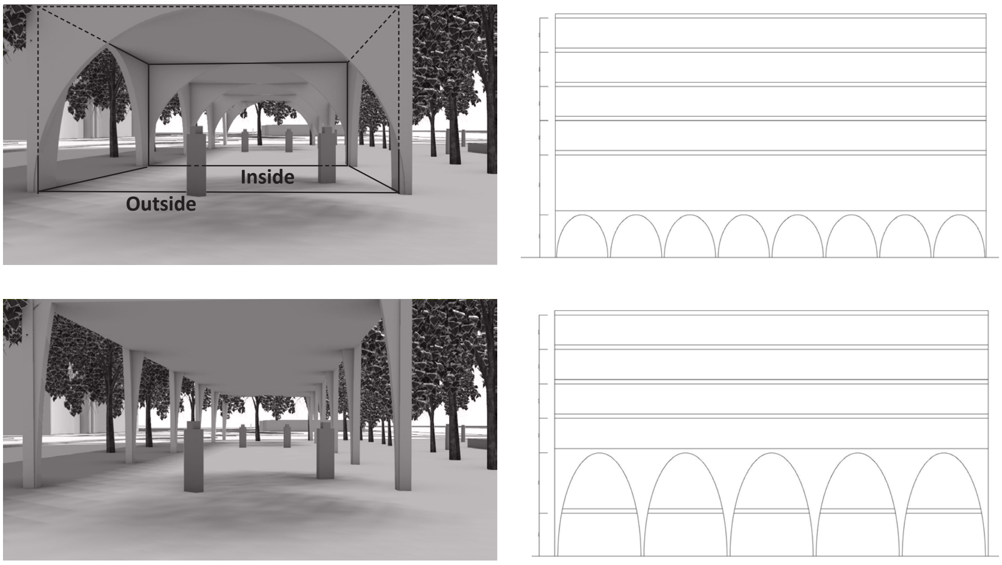
As described and illustrated above it is clear that the arch is a form frequently used in Paris in general and in the context around the site. This has inspired the project to investigate if, and how, the arch could be integrated into the design.

A potential is seen in working with the columns in relation to the trees on the site. A story of creating “another rov of trees” is found interesting.

Arches in the facade and as spatial elements

The arches are defining a very definitive space that divides the space under the building into almost absolut areas.

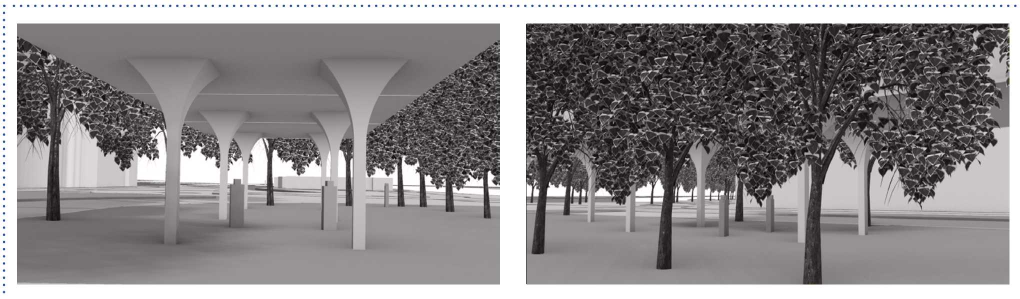
Creates a more flexible space, but still lacks an interaction with the contextual trees.



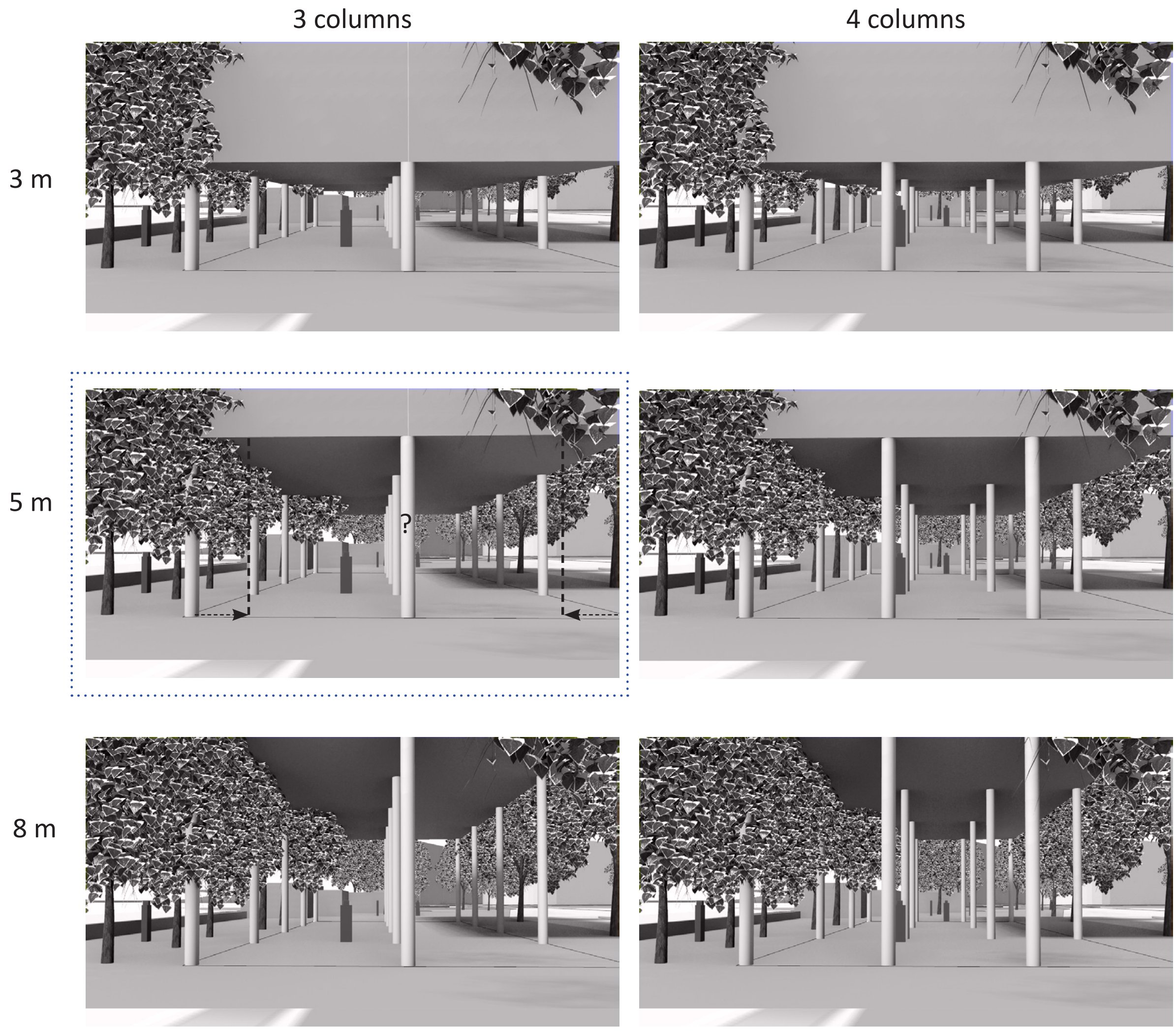
87. Arches in the facade and as spatial elements

Arches in interaction with the trees

These 3D visualizations give a clear indication that the arch can create an interaction with the trees.



88. Arches in interaction with the trees



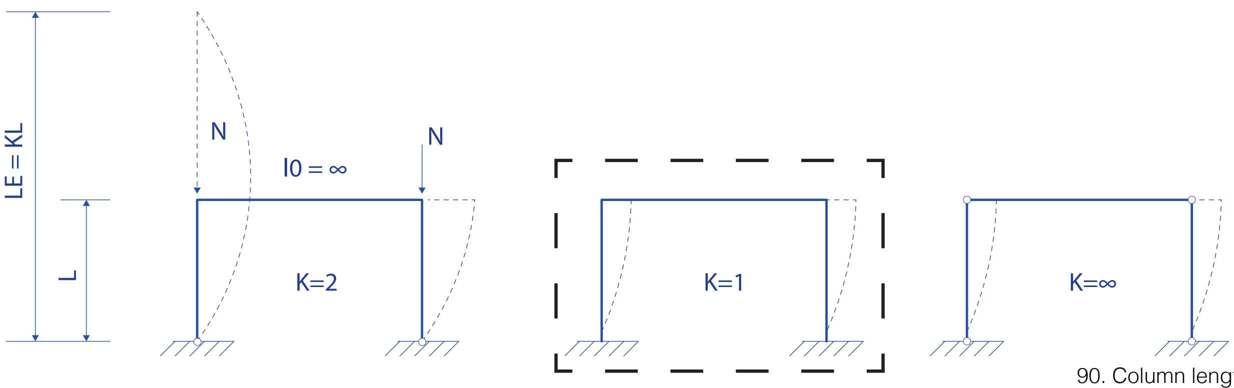
89. Column lengths

Racing the building

This investigation is conducted to give an understanding of how the height and quantity of the columns affect the space underneath the building. It gave the impression that the height of the columns should be approximately 5 m to create an open space. None of the iterations regarding the quantity of the columns were satisfying. The conclusion was to investigate how only two columns in each frame could be arranged to obtain the same effect under the building as beside the building.

Critical column length for sway frames

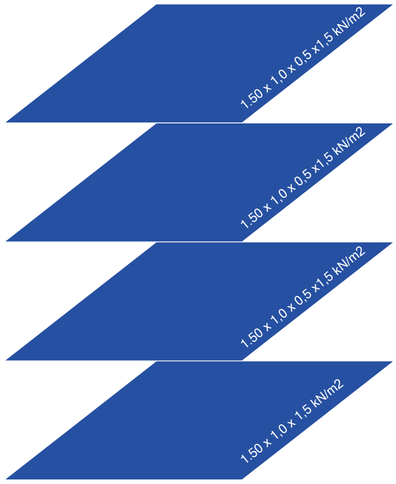
The investigation above concludes that the building should be raised 5 meters from the ground and possibly use a frame with two columns. Therefore it was investigated which type of frame had a small effective column length and thereby the good carrying capacity.



90. Column lengths

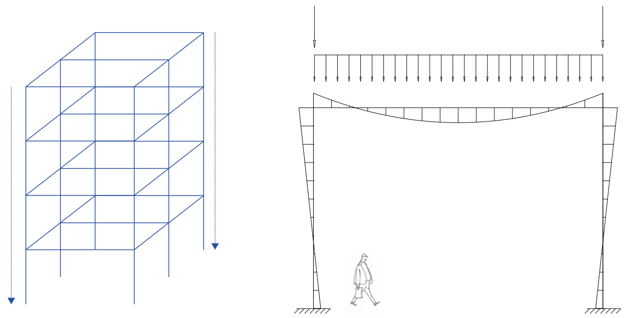
Load distribution, displacement and arrangement of columns

In order to get closer to how rows of two columns in the ground floor could be the solution, an investigation of the arrangement was conducted. It was investigated how the loads affected the ***space, moment and section.***



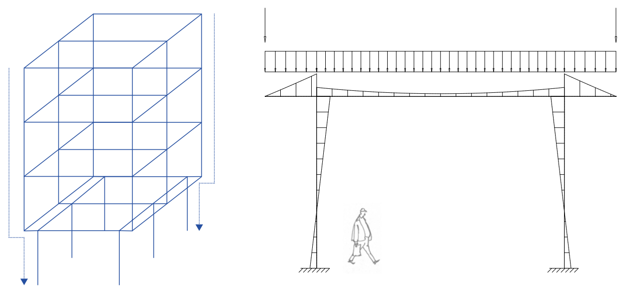
91. Loads

The moment curve in the columns is interesting as it, by its evolvement, can be interpreted as a tree trunk. The space underneath is on the other hand not that interesting and lacks a link between the space enhanced by structure and the space outside the structure.



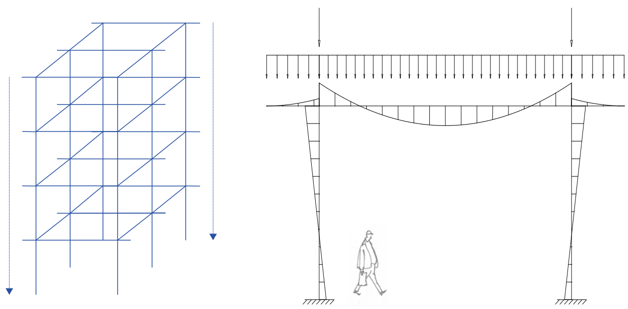
Member	Section	Material	Lay	Laz	Ratio	Case
1 column_1	OK, IPE 360 S235	S235	33.43	132.00	0.70	1 LL C

The moment of the column is similar to the one above. The space created by the structure is very different and has a potential to create a transition between the space created by the structural frame and the surroundings. The load distribution is however resulting in stressing the column more than the first one because of the introduced loaded cantilever.



Member	Section	Material	Lay	Laz	Ratio	Case
1 column_1	X, IPE 360 S235	S235	33.43	132.00	1.21	1 LL C

A rearrangement of the structural system results in a less stressed column and creates the same space mentioned above. It is decided to work further with this case.



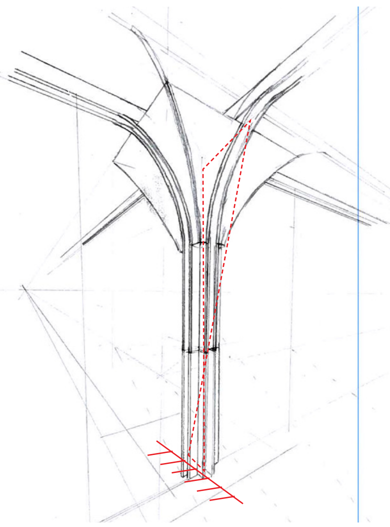
Member	Section	Material	Lay	Laz	Ratio	Case
1 column_1	OK, IPE 360 S235	S235	33.43	132.00	0.73	1 LL C

92. Loads and moment curve

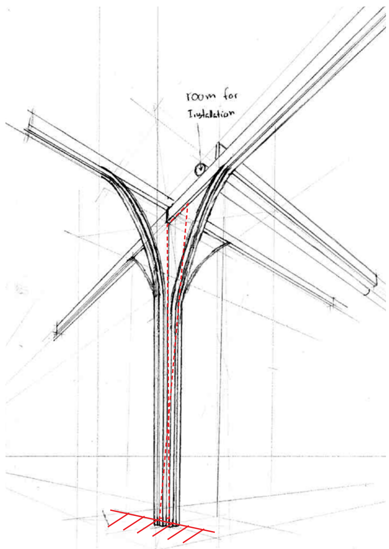
Column relating to trees and moment curves

This investigation was performed in order to get closer to the design of a steel column that interacts with the trees and uses the moment curve as the design driver. Sketch 93-95 highlights the goal to explore columns that were directly inspired by the earlier investigation on moment behavior (Illu. 92). The investigation had a couple of secondary focus areas like integrating technical installations (Illu. 94).

Sketch 96-98 concentrates the aim to investigating columns that were inspired by trees. Simultaneously, explore if the moment curves from earlier findings could contribute to creating an architectural expression that resembles the trees to create a cohesive experience enhancing the already attractive space under the tree crowns.



93.



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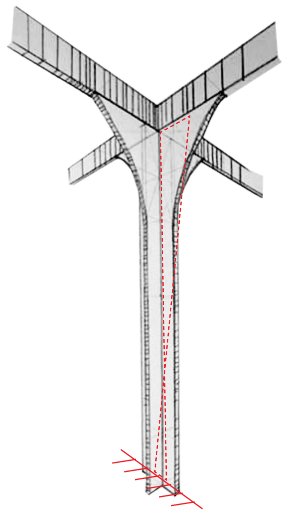

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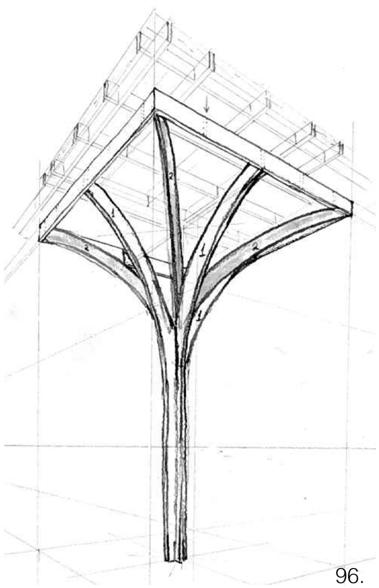

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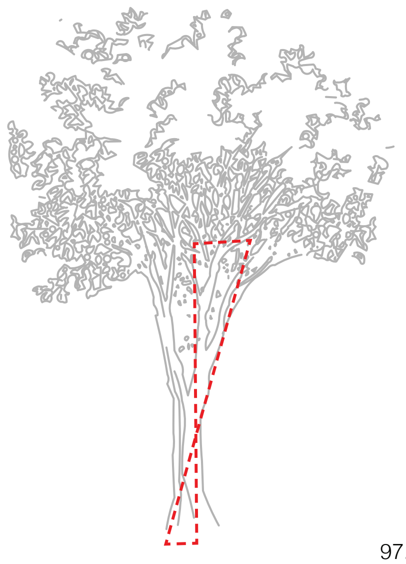

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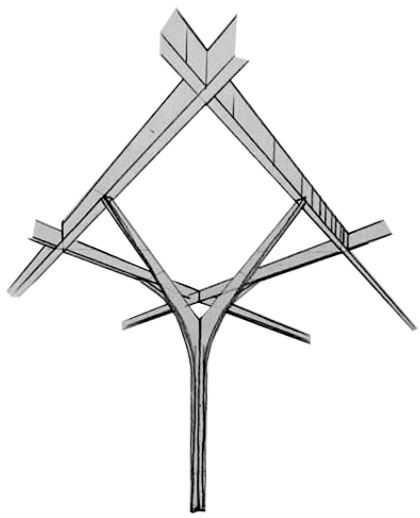
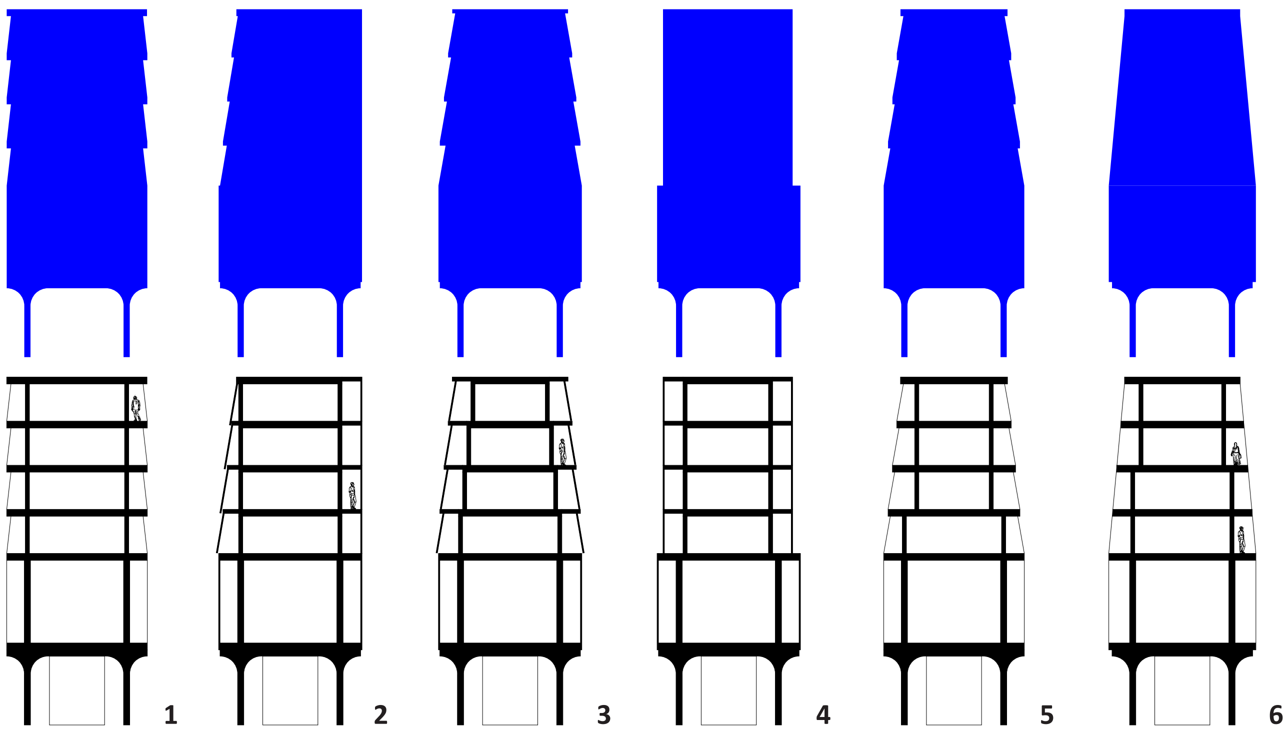


98.

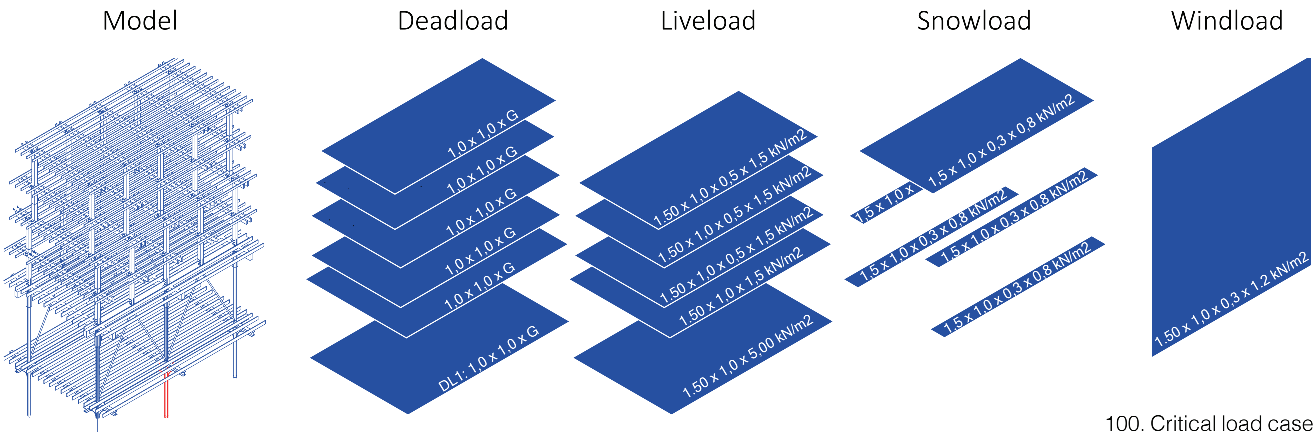
Loads & interpretations of 'head'

Critical load case

A small and slender section should secure minimal use of steel and is believed to have the potential to obtain a light architectural expression. The aim of this investigation was to unfold the critical load case as a natural evolution towards the design of the column section. Robot calculations were conducted (Appendix A) of different iterations regarding the arrangement of the structural elements (Illu. 99). The critical load case (Illu. 100) is using liveload as the dominating variable load and has snow load and wind load as the accompanying variable loads. Partial coefficients and combination factors are defined from reference formula 6.10b described in Eurocode 0 (Appendix A).



99. Sections and silhouettes

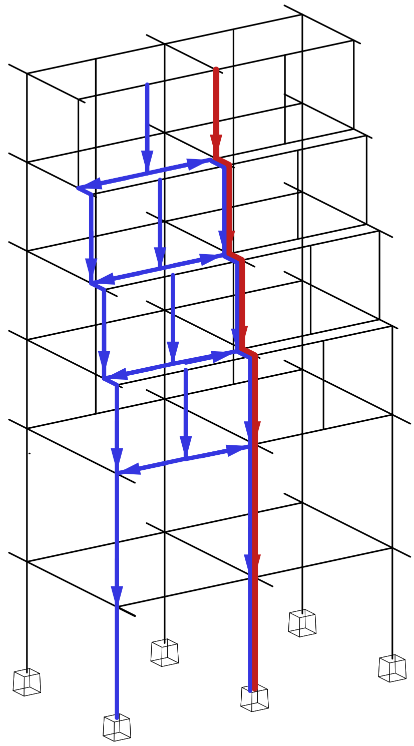


100. Critical load case

Load bearing structure and an interpretation of the 'head'

Due to the narrow space between the trees (ca. 11 m), defining the depth of the building, it was a wish to utilize as much of the apartment as possible all year round, resulting in a wish to create french balconies instead of terresses. The section of the building therefore became important both due to visual expression (Illu. 101-102) and the detailing of the load bearing structure (Illu.. 100).

As earlier mentioned, the understanding of the apartments as the buildings 'head' became important. The goal was to create a section and siluet that created a reference to the iconic mansard roofs of Paris. The visual expression of the 'head' and a wish of symmetry in connection with a simple loadbaring structure, where the loads were directly transferred to the columns underneath, appeared to be a challenge.



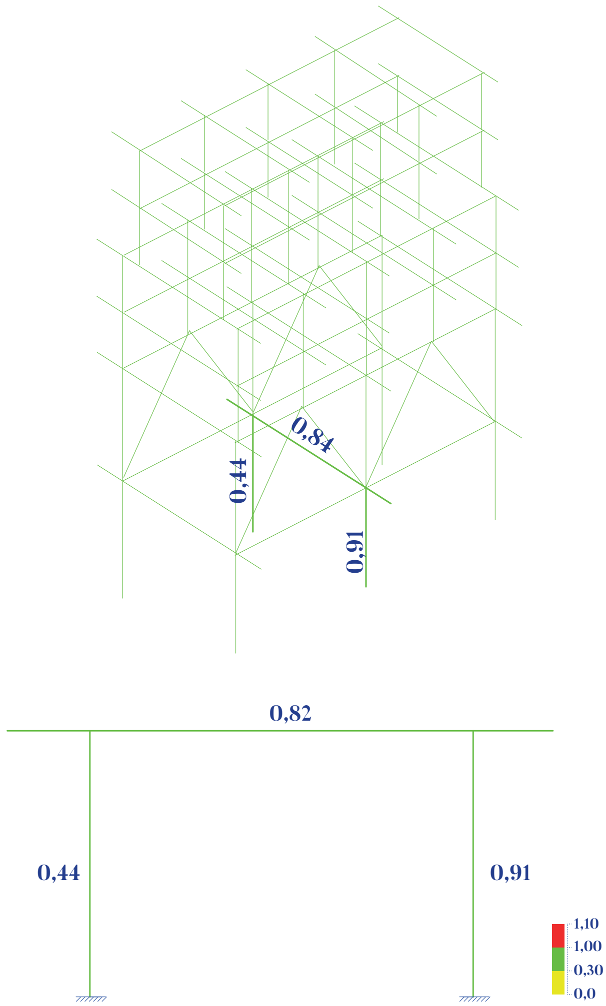
101. The complexity of leading the loads optimally through the construction.

Comments on sections and silhouettes

1-2 Creates an optimal construction for the loads to be transferred directly on top of each other.
1 Resembles a typical modernist building block.
2 Creates a 'front' and 'back'.
3 Creates the desired expression of the 'head' but complicates the construction.
4 Creates a less complicated construction but not the desired expression.
5-6 Creates a less complicated construction and the desired expression.

Utilization ratio

Through the calculations the utilization ratio of different elements has been explored in Robot to ensure tolerable conditions for elements which undergo detailed dimensioning. The presented situation is of final solution, clarifying that all elements in the investigated frame are within an acceptable utilization ratio. The lowest utilization ratio is 0.44 and the highest is 0.91. The column with 0.44 utilization ratio is not as stressed as the column with a 0.91 utilization ratio, because of a smaller surrounding area for load distribution and the applied wind load.

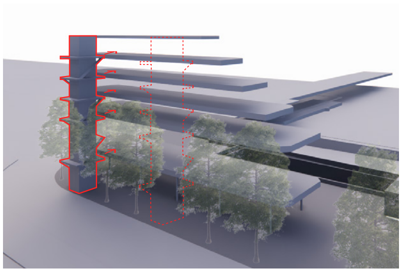


102. Utilization ratio

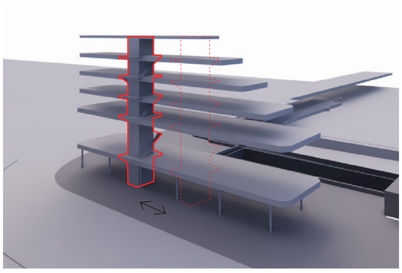
The flow - from base to body

The flow and connections in this project are crucial in relation to; the already existing flow and people in motion and transition, designing an inclusive and welcoming house, the expression of a *Neighborhood House*, accessibility and designing a variation between private and public access and finally the challenge to enter a raised building. These aspects need to correspond to one another, to enhance and intensify each other.

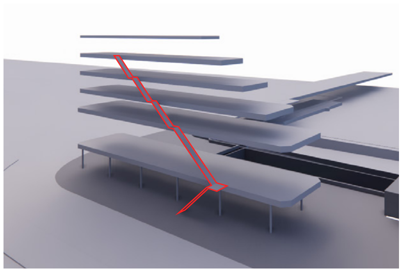
Initial flow concepts
The initial flow concepts revolved especially around the vertical connection and the challenges concerning the building shape, both in connection to the reduction in floor area and the width of the building. The intuition to have some kind of balcony access to minimize the occupation of heated area were based on the three principles underneath;



103. External flow



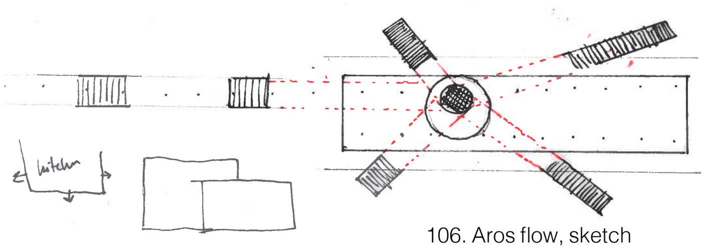
104. Internal flow



105. Extending the street

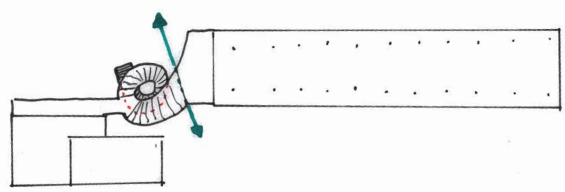
Overall concepts
The concepts *'Aros flow'* and *'flow in the middle'* have been developed as attempts to grasp all the mentioned aspects in the intro.

Aros flow
This concept tries to enhance all directions by extending '*connecting*' stairs out from a center. You then access the shared functions far away and walk on a raised flow towards the Shared functions. When the site and its functions are thought of as one connected space, this concept seems vague, as the center becomes the Shared Function, hence neglecting the Food Hub. Additionally, one needs to know that the entrance to these functions only is accessible from one of the ***'stair arms'***.



106. Aros flow, sketch

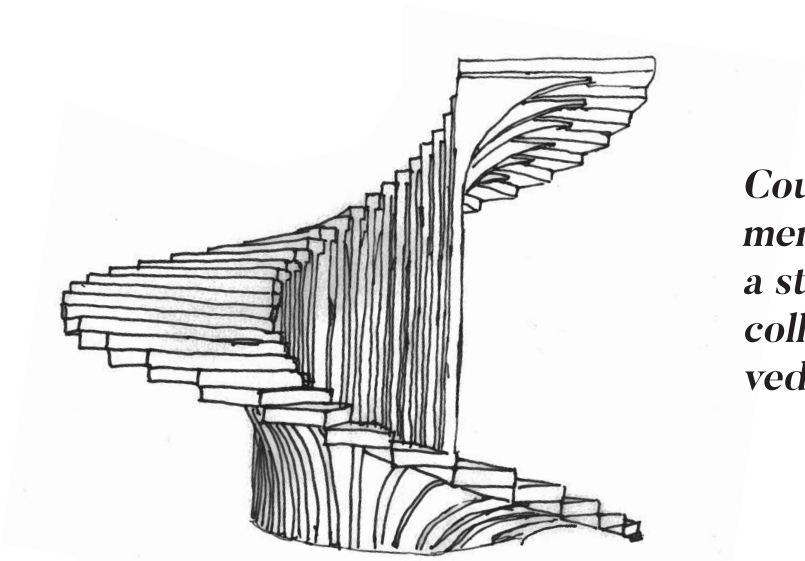
Flow in the middle
This concept operates from the center of the site, in the public urban space between the functions. The flow becomes a concretized '***urban gate***', but consequently blocks the connection to the metro and river. The connected spiral stair is by its form and flow not as explicit concerning direction, hence no direction or flow seems more important than another.
Nevertheless, this concept concentrates a desire to work with a flow that connects the different functions and indicates the next steps.



107. FLow in the middle, sketch

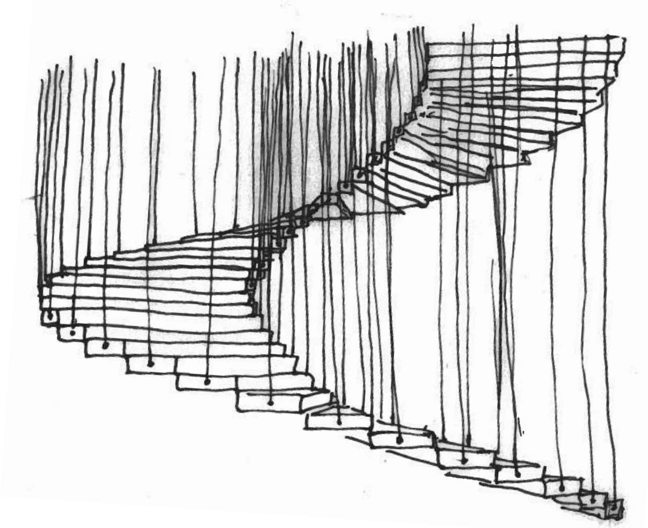
The staircase as a structural element?

With great intention to think of the staircases as a structural element, hence creating a strong connection between flow, the main structure and the building as a whole, a staircase was created on the basis of the columns on the ground floor (Illu. 108). However it seemed not feasible in relation to the dimensioning of the columns. At this point the columns were optimized and stressed to its limits, hence converting it into a staircase, outside of a precisely calculated arrangement, did not make any sense. However it is desired to think about the stairs the other way around. They can only exist in their form and shape because of the structures (Illu. 109);



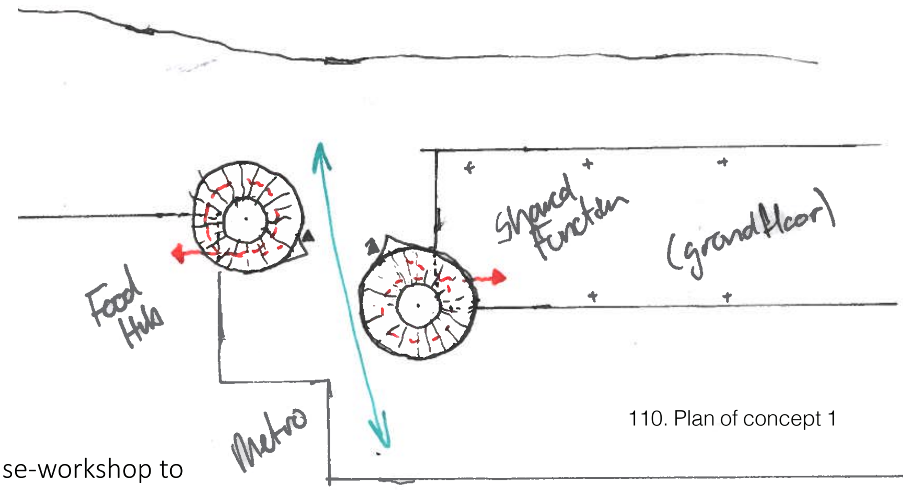
Could the stair be a structural element? Could a column evolve into a staircase? Would the building collapse if the staircase was removed?

108. Stair as structural element



Could the stair hang in the structure? Is the expression of the stair the opposite of the columns, hence light and open?

109. Stair reliant on the structure



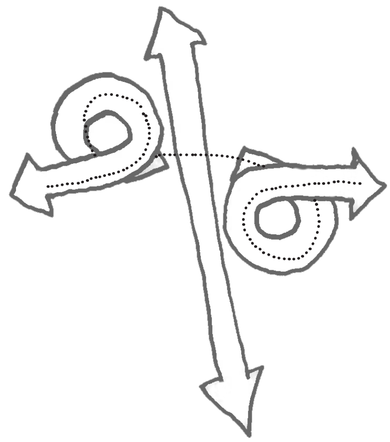
110. Plan of concept 1

Spiral flow

These concepts are based on a staircase-workshop to extend our stair-case repertory.
In both concepts the spiral stairs are separated but interfere differently with the open space between the buildings.

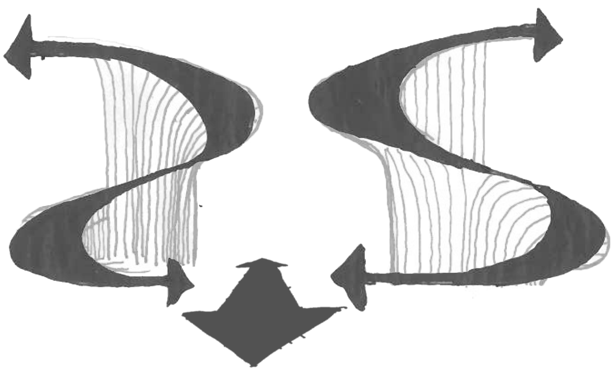
Concept 1 - Between the buildings

- The two staircases are placed between the buildings in the urban space.
- They are *'framing'* the way to the Seine and become an ***'urban gate'***. A consequence is that they 'take up' a lot of space .
- As the diagrams show, the *'concept'* is the idea of being ***'spiraled'*** up in either the Food Hub or the Shared Space.
- The Food Hub and the Shared Space are *'connected'* implicitly by the run of the stairs creating a continuity between them, simultaneously with a free urban space leading towards the Metro and the new Stairs down to the river.

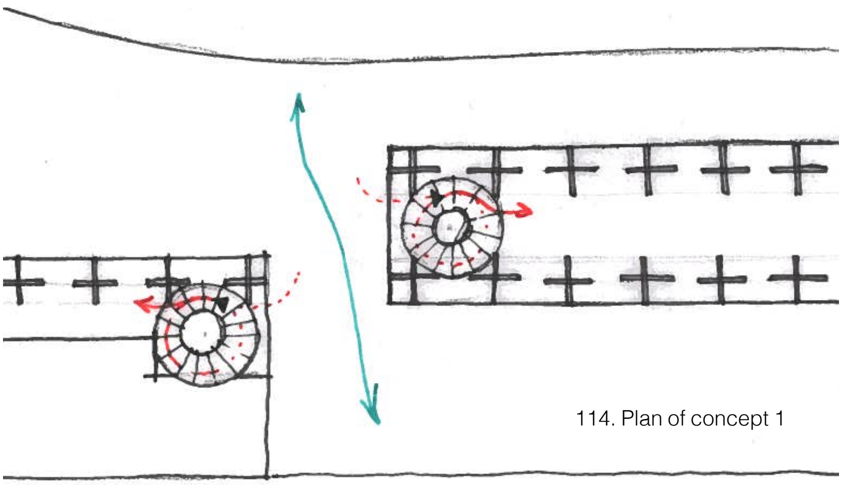


111. Plan diagram of concept 1

112. Volumestudy of concept 1



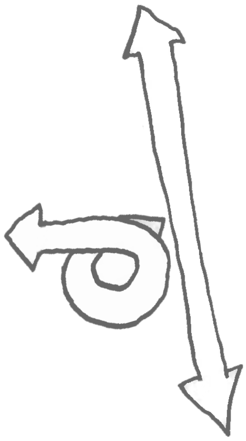
113. Volume sketch of concept 1



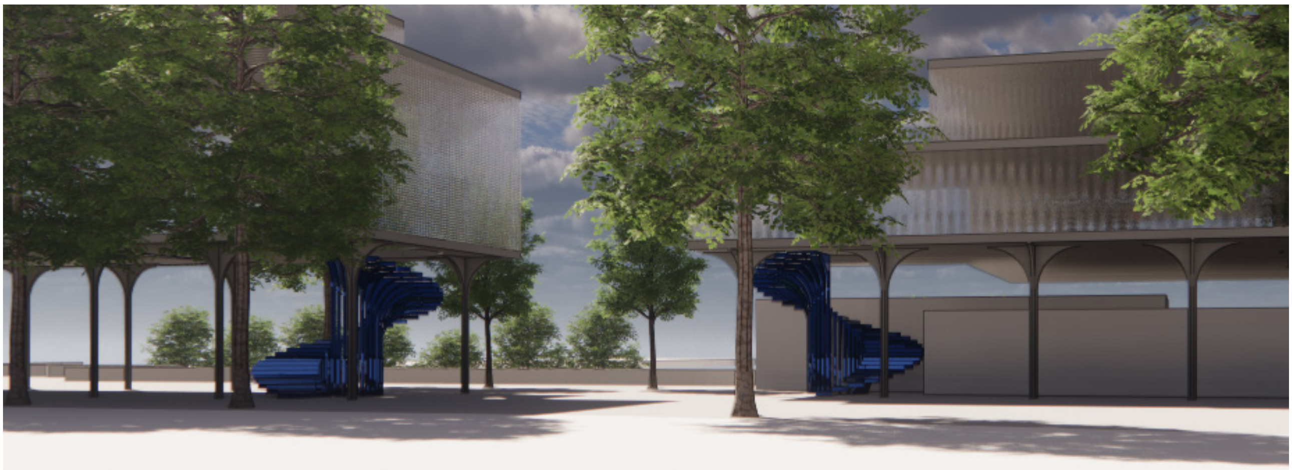
114. Plan of concept 1

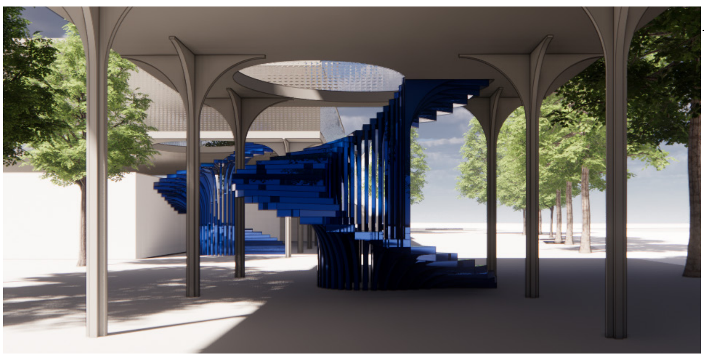
Concept 2 - Under the buildings

- This concept is more '*strict*' in line with the columns in the ground floor
- It creates a bigger urban space between the buildings, and articulates the space under the buildings more directly.
- It is assessed that, if the two stairs become more visible (materiality, color etc.) they could have the same strong ***'urban gate'*** qualities, while providing more free space for the flow.
- The link to the construction and columns is somehow detached, and becomes another object. *Are they competitors?*



115. Plan diagram of concept 1





116. Volumestudy of concept 1

Shared functions - the body

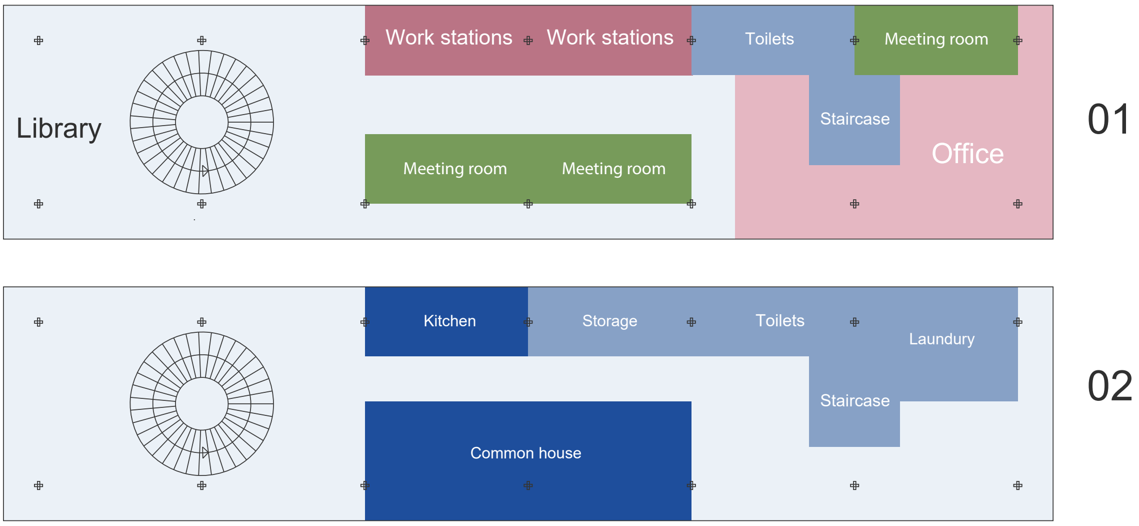
As described in design principle 7 (page. 88-89), it is a wish to create a building that can be adapted over time, due to the focus on new modes of living. The shared functions must accommodate the ever changing needs of the residents and the remaining neighborhood. Therefore it was desired to create a dobbel-hight space, where the construction was able to stand freely without the support of any interior elements like walls or floors. The plan solutions for the space of the ***shared functions*** was weighed against this parameter.

Suggestion 1
Suggestion 1 shows a plan solution where rooms and spaces are placed along the facade of the open room. This creates great daylight for the specific rooms, but leaves an unwelcoming dark hallway in the inner part of the building. Furthermore the construction of the rooms becomes a part of the load bearing structure, which is not the intention. A floor structure on level 02 also erases the understanding of a double height space.

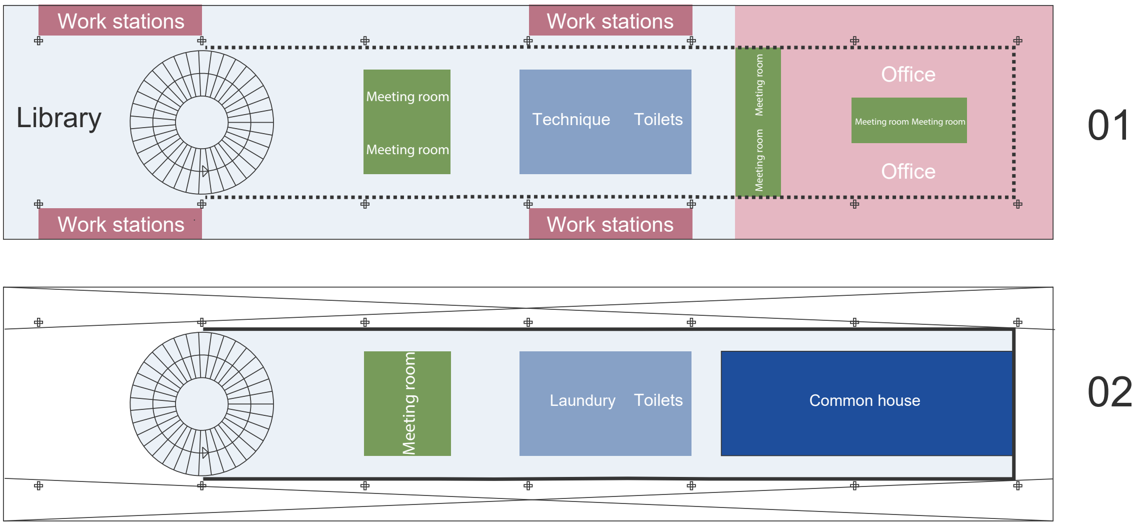
Suggestion 2
Creating level 02 in only the inner part of the doubelt high room leves the facades free for daylight to penetrate the entire room. The free facades also showcase the doubelt high room and the programming of the space, leaving a connection between the two floors. The programming is clear and simple, and the load bearing structure is showcased in no connection with the construction of the interior rooms.

Suggestion 3
Suggestion 3 is an attempt to utilize the possibility to let rooms be in connection with the facade while the doubled high room is still visible. The functions are strategically placed to let the construction on level 02 rest on the construction of level 01. However, it is a wish to showcase the doubled high room even further than accomplished. The plan on level 01 shows a space that, as a consequence of the volumes, creates spatialities that can be utilized for small niches which is considered a nice quality.

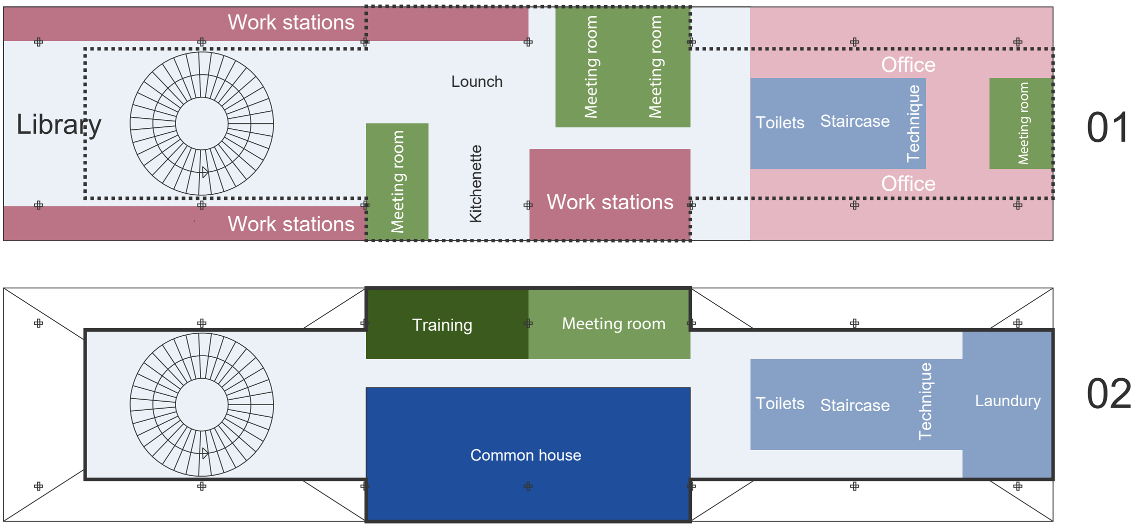
Suggestions 2 and 3 create the basis of the further work and the final attempt to create a plansolution for the shared functions. The final plansolution, presented in the presentation is an attempt of merging the qualities found in the spatialities on level 01 of suggestion 3 with the rigid and clear orginication of suggestion 2 while working even further with the understanding of a double high space, where the load bearing structure is not interrupted by the structure of the interior spaces.



117. Plan sugestion 1



118. Plan sugestion 2



119. Plan sugestion 3

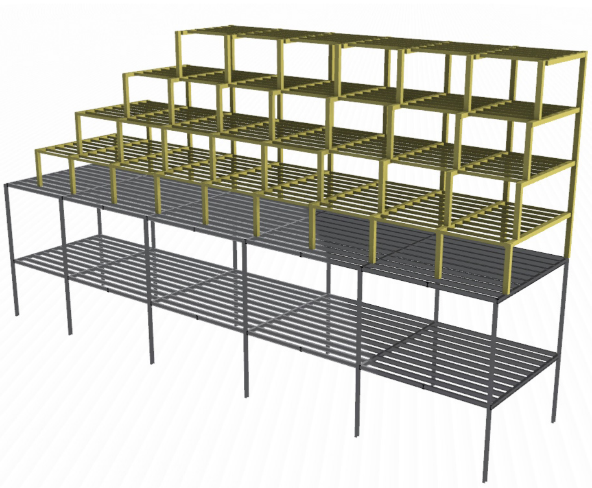
A structural telling of functions and materials

Parallel with the columns and the materiality in the ground floor an overall structural principle has been developed based on the following statements; (these should be understood as addition to the presented tectonic approces)

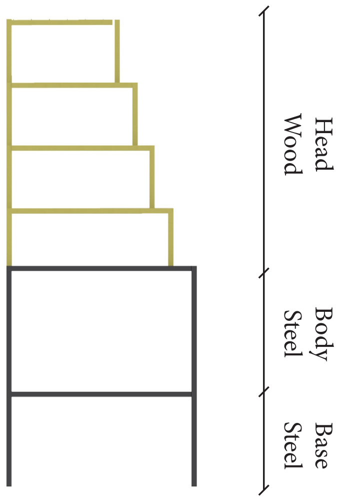
*How can the structure **emphasize** transition between functions (public/private) through a change in scale/dimension, atmosphere, level of connections (views, insight, openings, light), materials, etc.?*
*How can structure and materiality **articulate** the meetings between elements and space through appearance and tactile properties, and by that relate to the human scale and body?*

These aspects relate strongly to the different functions and level of private-public characteristics. The overall desire is how the structures and materiality can intensify, enhance and indicate changes in functions and the relation to the human scale harmonized to either private or public zoning.

Princip
Steel is used in the ground floor and a double-height 1. floor, to create an open and light expression, which as a consequence becomes a flexible space suitable for the functions and activities. The qualities of steel are utilized as the construction carrying the heaviest load (tabel 121).
On the upper floors wood is used as a structural material relating with its tactility, warmth and color to the human body. Both concerning scale and the feeling of home, when the users come closer to the structures.



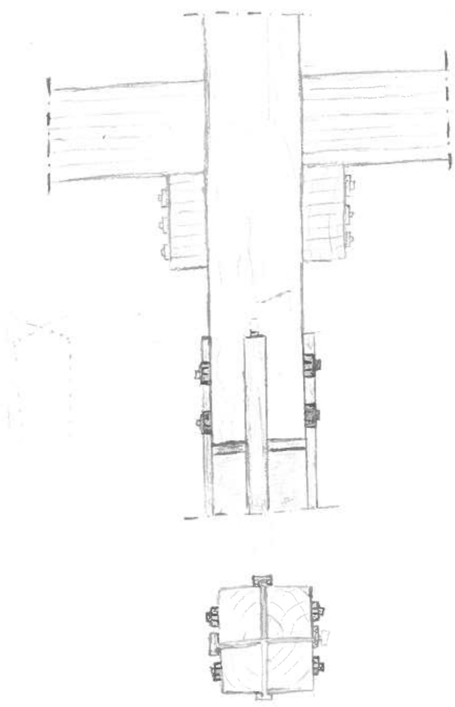
120. Division of steel and wood construction

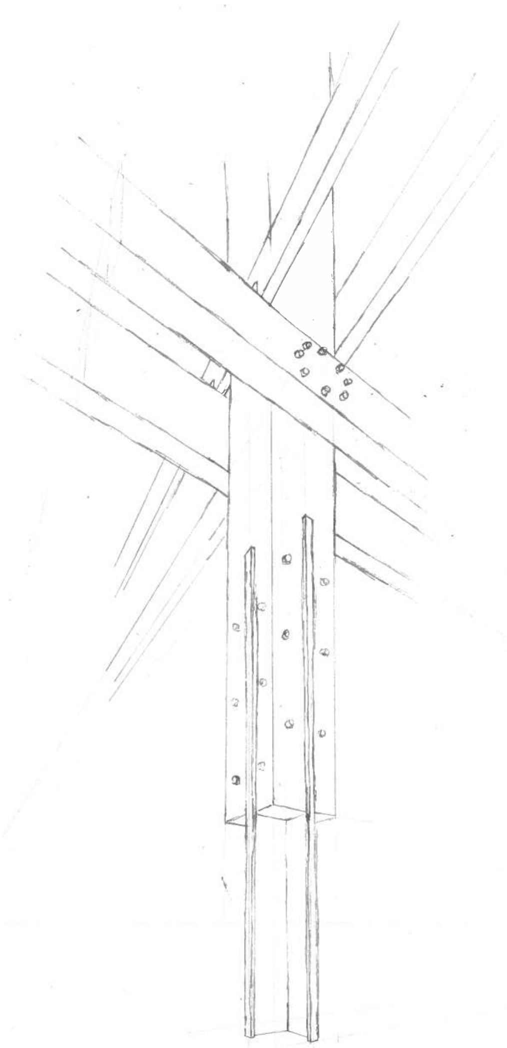


	Wood	Concrete	Steel
Coefficient of elasticity, E [MPa]	9.000 MPa-11.000 MPa	20.000 MPa- 40.000 MPa	210.000 MPa
Strength, f [MPa]	24 MPa	35 MPa	235 MPa
Strength/density, f/ρ [MPa m^3/kg]	0,07 MPa m^3/kg	0,015 MPa m^3/kg	0,03 MPa m^3/kg
	Anisotope		Isotope

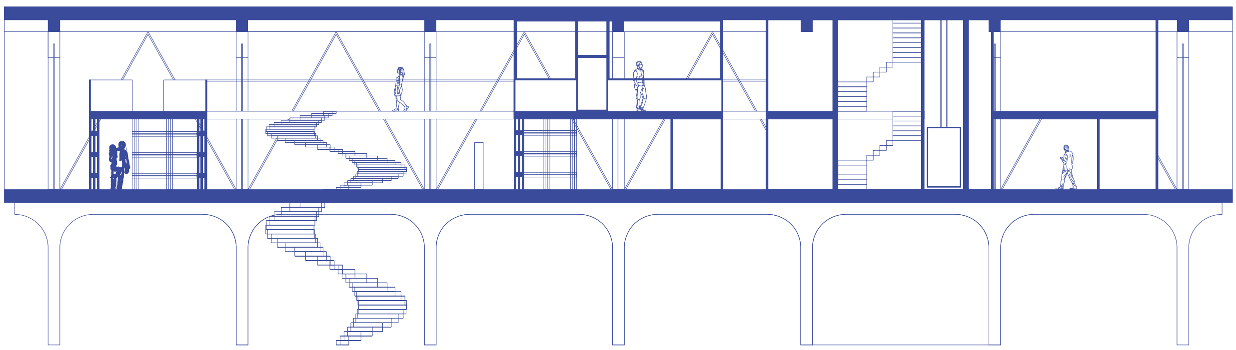
121. Table of material characteristics (Frier, n. d.)

The meeting between timber and steel could further enhance the change of function. This was done by focusing on the joint of the two elements, this resulted in letting wooden elements penetrate through the ceiling and thereby making a change of material that is visible in the upper part of the shared space (Illu. 122). The steel and the timber column overlap and give the users of the public space an indication of a change in function.





122. Sketch, joint between steel and wood



123. Sketch, joint between steel and wood

Indoor Environment explorations

Goal

Indoor environment investigations have been conducted for the shared space as design drivers to increase the desire of an integrated design process, hence to boost the design process, especially the facade design (See appendix B for more details). Simultaneously the energy performance has been investigated for each iteration with the desire to find a balance between the two often contradicting aspects (See appendix D for details). The intention is to create an open and flexible space with less spatial and structural boundaries. With the intention to have great visual connection both from inside towards the surrounding context and from outside in, the window-wall ratio is of interest in harmony with the indoor environmental conditions. The following indoor environment aspects will be examined; atmospherical, thermal and visual.

Delimitations

It is in general desired to actively through the design process use inputs from the results of calculations and simulations to generate a more critical design thinking, which eventually could boost the creativity in an integrated and holistic manner. The goal is not to make detailed set-ups and models to conduct results only as check-points of achieved indoor environmental conditions. The foundation of all simulations are based on ISO/European Standards (tabel 124).

Aspect	Category: II, 2, B	Reference
Atmospheric conditions CO_2 concentrations above outdoor concentration	500 ppm	DS_EN 15251: Annex B, table B.4
Thermal conditions operative temperature °C summer winter level of tolerance transgression of operative temp. non-residential above 26 °C above 27 °C residential above 27 °C above 28 °C	 24,5 ± 1,5 22,0 ± 2,0 100 hours 25 hours 100 hours 25 hours	 DS/CEN/CR 1752:2001, Tabel 1 (BR18 (§ 385 - § 392), 1.0
Visual conditions lighting	300-500 lux	DS_EN 15251: Annex D, tabel 1.D

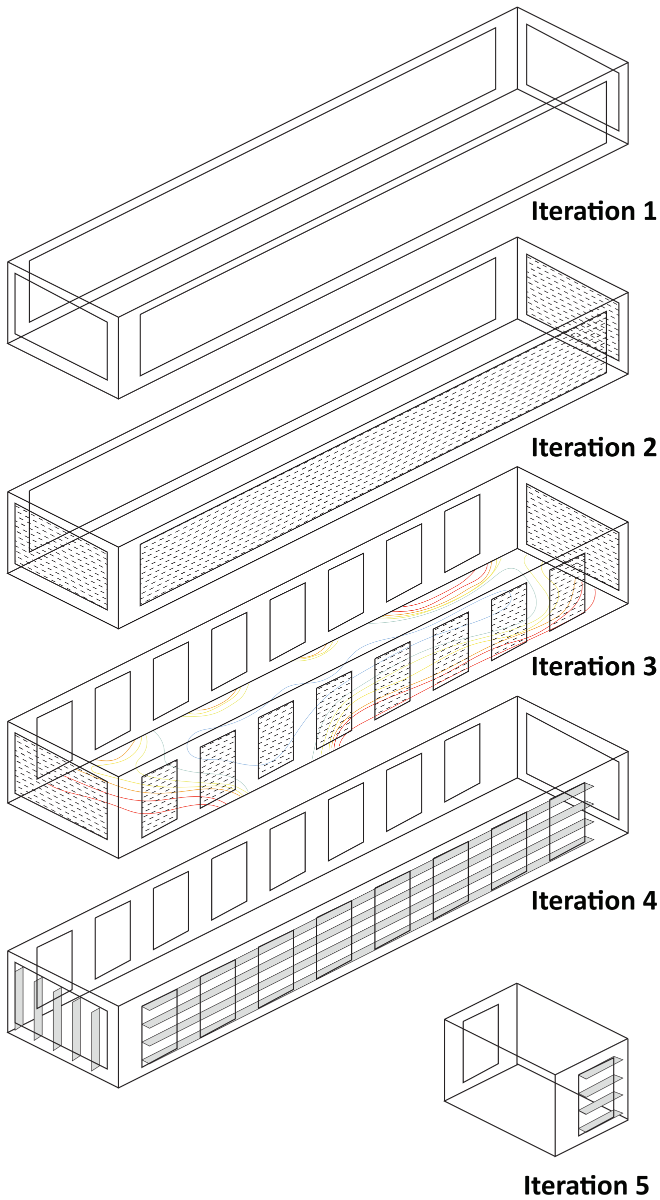
124. Table of Requirements specification

Info

- 50 people
- Systems (see appendix C for calculation methods); ***equipment, heating, infiltrations, venting, ventilation, people load***

Construction

- External walls U-value: 0,12
- Floor U-value: 0,11
- Window U-value: 0,82 and g-value: 0,7



125. Shared space with shading and DF

Windows and shading

The windows are openable to exploit natural ventilation and the SolarShading is based on external '*screens*' for iteration 1-4 and external '*venetians*' for iteration 5 which is chosen to imitate horizontal lamellers as a static passive solar shading. To imitate the blocking of the trees, which naturally functions as passive solar shading, side-fins and overhangs are added to the windows.

Iteration 1: Big windows - no Shading
Window area: S/N: 200 m2, E/W: 37 m2
BSim
CO_2: 415,3 ppm
tOPmean summer: 23,3°
tOPmean winter: 22,3°
Hours above: 26°: 386, 27°: 268

Iteration 2: Big windows - with Shading
Window area: S/N: 200 m2, E/W: 37 m2
Be18
Energy frame: 47,1
Excessive in rooms: 0
BSim
CO_2: 407,8 ppm
tOPmean summer: 22,6°
tOPmean winter: 22°
Hours above: 26°:161, 27°: 85

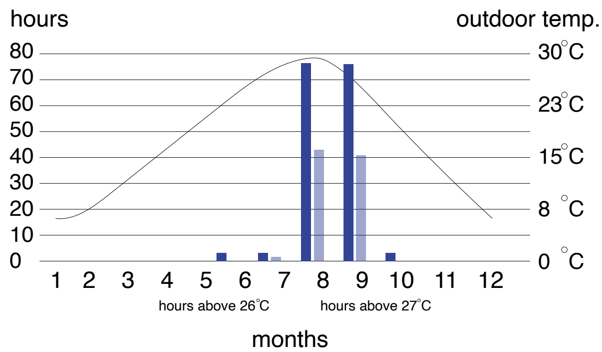
Iteration 3: Half windows - WITH Shading
Window area: S/N: 100 m2, E/W: 37 m2
Be18
Energy frame: 41,1
Excessive in rooms: 0
BSim
CO_2: 423 ppm
tOPmean summer: 24,6°
tOPmean winter: 23°
DF: see figure
Hours above: 26°:85, 27°: 43

Iteration 4: New Shading type (Venetians)
Window area: S/N: 100 m2, E/W: 37 m2
BSim
CO_2: 416,6 ppm
tOPmean summer: 24,4°
tOPmean winter: 22,8°
Hours above: 26°:**73**, 27°: **33**

Iteration 5: Small Zone
Window area: S/N: 21 m2,
BSim
CO_2: 488 ppm
tOPmean summer: 25,6°
tOPmean winter: 23,5°
Hours above: 26°:91, 27°: 56

Sum-up

As the plan and layout process (see page 118-119) highlights, the goal is to design an open, double-height space suitable for changes through time. The results of the iterations shows as a consequence of the building shape acceptable operative temperatures, while critical conditions concerning hours above 26 and 27 degree. The iterations explore different solutions of window-wall ratio and Solar Shading settings to minimize the challenge of excessive heating. To challenge the initial approach a new BSim model of a conceptual smaller section (Illu. 125, iteration 5) of the whole shared space was simulated, but without any significant improvements. The passive solar shading and window-wall ratio from Iteration 4 (Illu. 125) has been the foundation for the final facade solution. In addition, the results also show clearly that only two months contributes to the excessive heating (Illu. 126), this is because the outdoor temperature is significantly higher than the desired conditions. It could be discussed if it is the right solution to '*fight*' against the seasonal climatic conditions to obtain fixed indoor conditions, which is of great importance and leads to a general better experience of indoor space. It could be argued that grounded in the climate crises of today, the solutions could be to reinvent the understanding of desired conditions. ***Could they be flexible by the means of seasonal adjustments creating a harmony between energy performance and the planetary boundaries in relation to the indoor environment?***

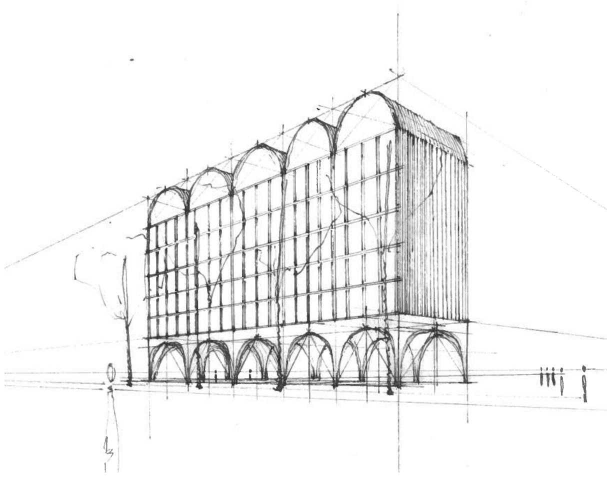


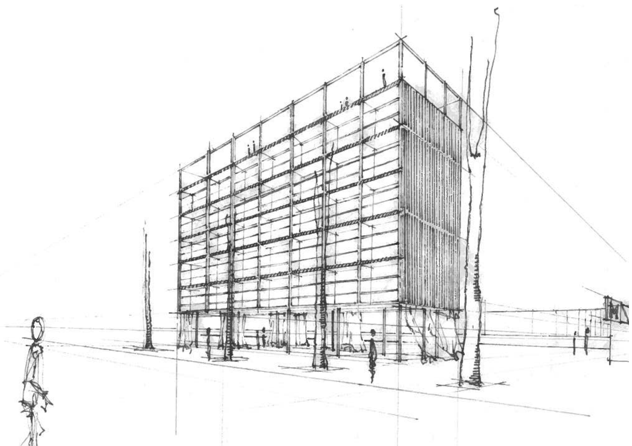
126. Houers above 26° and 27°, iteration 2

Facade design
– Shared space, the ‘body’

The materiality and tactility of Paris is an important parameter in the creation of the visual expression. It was experienced that the majority of the building blocks had a surface of limestone, a robust and heavy material in a light color. The use of plaster on top of stone is also found, where the passing of time and patina is shown in the beautiful demolition (Illu. 134). Wood could, as a sustainable and lightweight, untreated material, become a facade cladding that would show the passing of time through patination into a light gray color that would fit into the color gamut of Paris.

The layering and rhythm of the facade was an important element as seen in the analysis ‘Collected language’ page 72-77. Both the horizontal band and the vertical rhythm was important. The facade expression of the ‘shared space’ should invite people inside and showcase itself as an open and inviting house. Furthermore it should be clear that the space was one big doubled high room and not two separate floors. In both suggestions, using a horizontal window band (Illu. 128) and big vertical floor to ceiling windows (Illu. 129), one would understand the spatiality behind the facade. However the horizontal band had an easier time telling the story of different volumes in the double height room while it was possible to see the actual development of the space.





127.Sketches of facade

128. Horizontal windows

129. Vertical windows

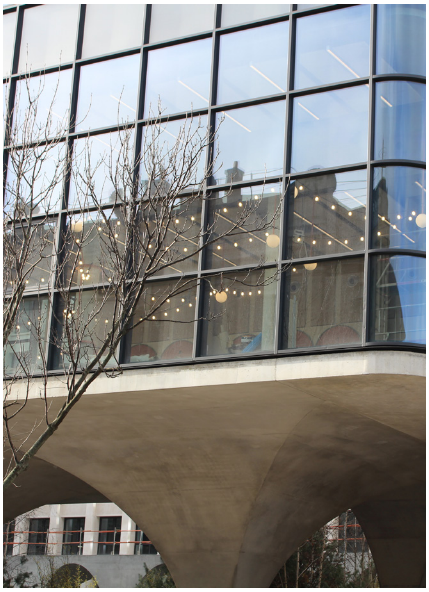
130.

131.

132.

133.

134.



135.

Apartments, the *'head'*

Plans, layout and organisation
To create a mixed use house reflecting life at different times of day, it was a necessity to create dwelling units. The goal was to create apartments in different sizes offering different family types and people to inhabit the building, promoting new modes of living (Illu. 136).

136. Diagram of apartments

Indoor Environment exploration
The indoor environment is tested for a small apartment. The goal is to get an understanding of the window-wall ratio, the needs for solar shading and the daylight conditions. The simulations are based on the following information, and will be presented with results to each iteration. A summary is found afterwards.

Info

- 2 people
- Systems (see appendix C); ***equipment, heating, infiltrations, venting, ventilation, people load***

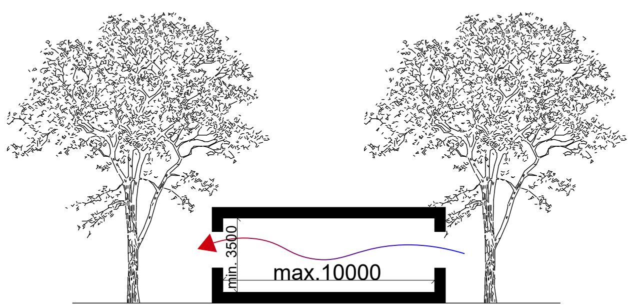
Construction

- External walls U-value: 0,12
- Window U-value: 0,82 and g-value: 0,7

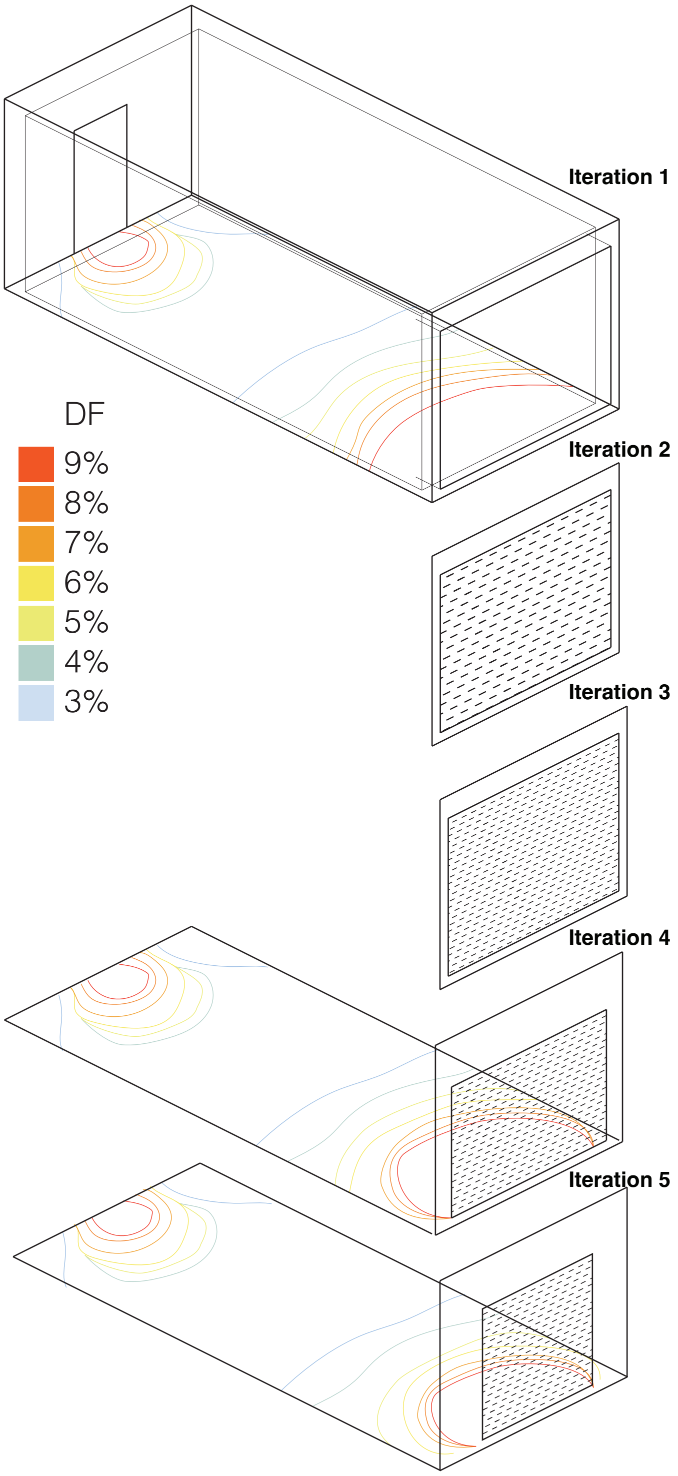
Windows and shading
The windows are openable to exploit natural ventilation and the SolarShading is based on an external 'screen' which is chosen to imitate an awning. The Shading is active all year around between 8.00-17.00. See the setting in appendix C.

Sum-up
It is very clear that the solar shading is very important to ensure thermal comfort, as well as optimization of the energy performance. Nevertheless a conflict is existing between the energy performance and passive solar heating as the energy performance is worsening with the window area decreasing in size. A balance between the thermal and visual conditions and the energy performance is found in iteration 5.

Ventilation
Cross ventilation, single sided ventilation and thermal buoyancy are all suitable due to the dimensions of the apartments.



137. Cross ventilation



138. Apartments with shading and DF

Iteration 1: Big window WITHOUT solar shading
Window area: 3,2x2,9 = 9,3 m2

Be18
Energy frame: 52,2
Excessive in rooms: 5,5
The 'excessive heating'-value in rooms is the equivalent electricity needed to remove the excessive heating with a standard mechanical refrigeration system. The value needs to be 0.

BSim
CO_2: 497 ppm
tOPmean summer: 26,3°
tOPmean winter: 22,6°
DF: see figure
Hours above: 27°: 1108, 28°: 875

Iteration 2: Big windows WITH solar shading (F_c = 0,5)
Window area: 3,2x2,9 = 9,3 m2

Be18
Energy frame: 53,7
Excessive in rooms: 4,7

BSim
CO_2: 507,5 ppm
tOPmean summer: 24,7°
tOPmean winter: 22,2°
Hours above: 27°: 510, 28°: 317

Iteration 3: Big window WITH solar shading (F_c = 0,1)
Window area: 3,2x2,9 = 9,3 m2

Be18
Energy frame: 54,2
Excessive in rooms: 4

BSim
CO_2: 515,5 ppm
tOPmean summer: 23,8°
tOPmean winter: 22°
Hours above: 27°:147, 28°: 80

Iteration 4: Smaller window WITH solar shading (F_c = 0,1)
Window area: 2,9x2,5 = 7,25 m2

Be18
Energy frame: 53,8
Excessive in rooms: 2,7

BSim
CO_2: 516,7 ppm
tOPmean summer: 23,7°
tOPmean winter: 22°
DF: see figure
Hours above: 27°:110, 28°: 42

Iteration 5: Smaller window WITH solar shading (F_c = 0,1)
Window area: 2,5x2,1 = 5,25 m2

Be18
Energy frame: 50,2
Excessive in rooms: 0

BSim
CO_2: 527,3 ppm
tOPmean summer: 23,6°
tOPmean winter: 22°
DF: see figure
Hours above: 27°:84, 28°: 26

Facade, materiality and expression

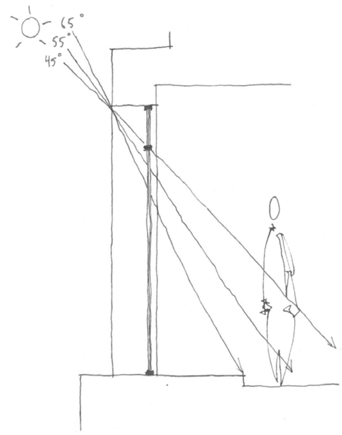
The facade of the building obtains many important functions and is an important parameter in terms of indoor environment. As earlier mentioned the ratio of glazing compared to climate envelope was investigated to insure the thermal comfort and the visual conditions (pp. 126-127). Different facade expressions of the dwellings, the ‘***head***’ of the building, were investigated.

An important aspect of the facade, due to mentioned thermal comfort and visual conditions, was the implementation of solar shading. With the main part of the facade oriented towards south-vest the shading should be able to block the high midday-afternoon sun, during summer. As seen around Paris, shading, which is controlled by the user, is a commonly used element. However the most commonly used shading in Paris, as investigated on page 80-81, does not leave many opportunities in terms of visual and spatial quality for the user. It is a wish to challenge this investigation and work with a shading that creates behavioral opportunities for the occupants.

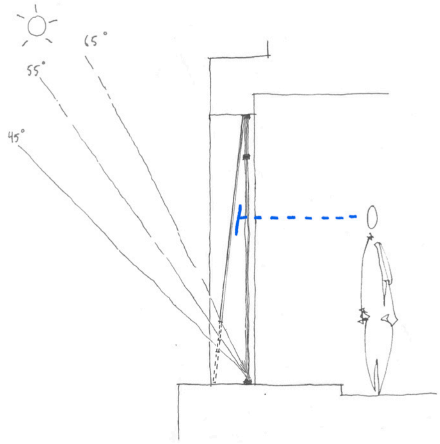
Shading, visual- and occupant conditions
The investigation of the two different types of shading (Illu. 139) led to the decision of creating a flexible awning as shading that would also function as a great part of the facade expression.

Shading, facade expression
It was a wish that the solar shading became an integrated part of the facade expression, and therefore the visual expression was investigated simultaneously with the function and effect (Illu. 140-143).

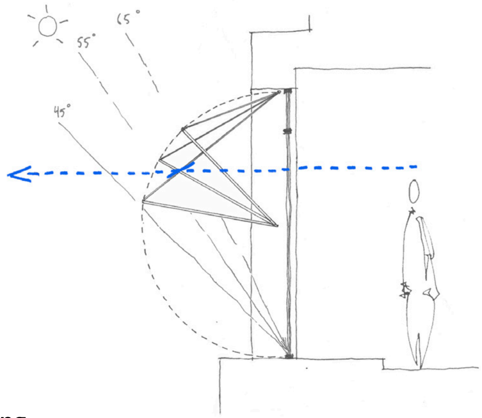
For the shading to become an integrated part of the facade expression, it became clear that the shading should follow the entirety of the apartment module (Illu. 142-143), otherwise it became an add-on and a separate curtain element (Illu. 140-141) instead of a facade. Furthermore the visual play in the facade, created using the flexible awning, becomes a symbol of the occupant of the apartments that brings character and life to the building (Illu. 142-143).



No shading
- The summer sun penetrates the room and creates an unpleasant thermal environment due to overheating.



Fixed curtain
- The curtain is fixed and can therefore withstand the wind.
- Blocks the high sun, when almost totally closed.
- Leaves the occupant without a view if the sun is desired to be blocked.
- Creates a greater barrier between indoor and outdoor space during the summer months when the curtain is closed.

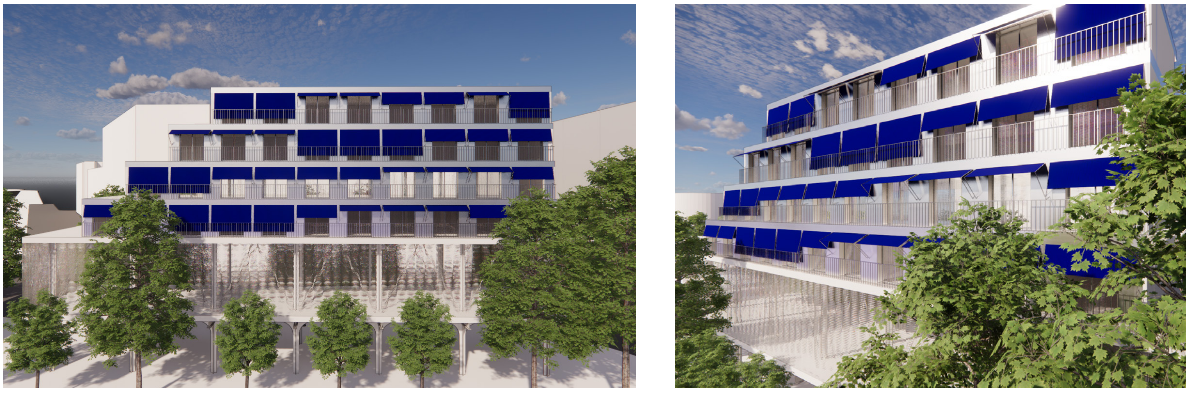


Flexible awning
- The curtain is flexible and therefore invites the user to interact and creates great behavioral opportunities.
- The curtain is more sensitive towards wind.
- Due to the flexibility the curtain can block the high summer sun while leaving the user with a view.
- Does not create a barrier between indoor and outdoor space.
- Creates a dynamic and lively facade expression showcasing the individuality of the occupants.

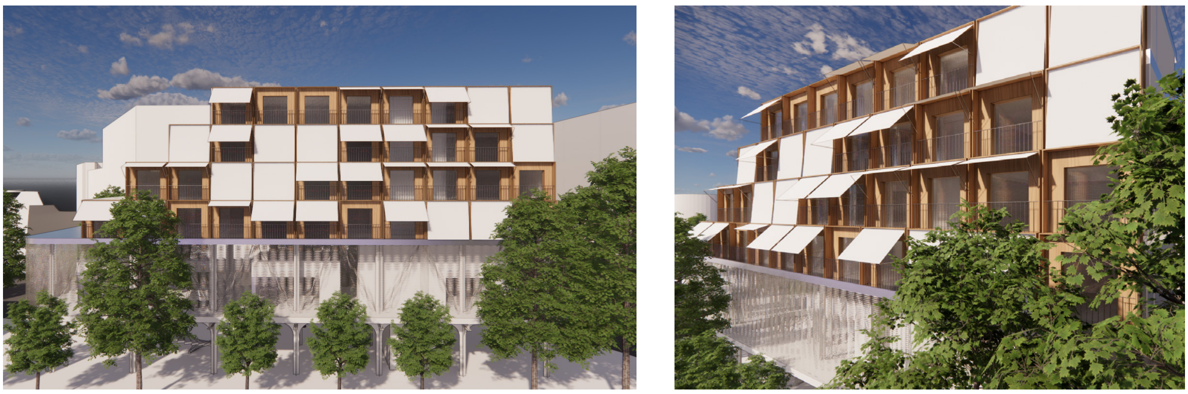
139. Solar shading

140. The fixed curtain placed only by the window becomes an add on and a single curtain instead of a facade element

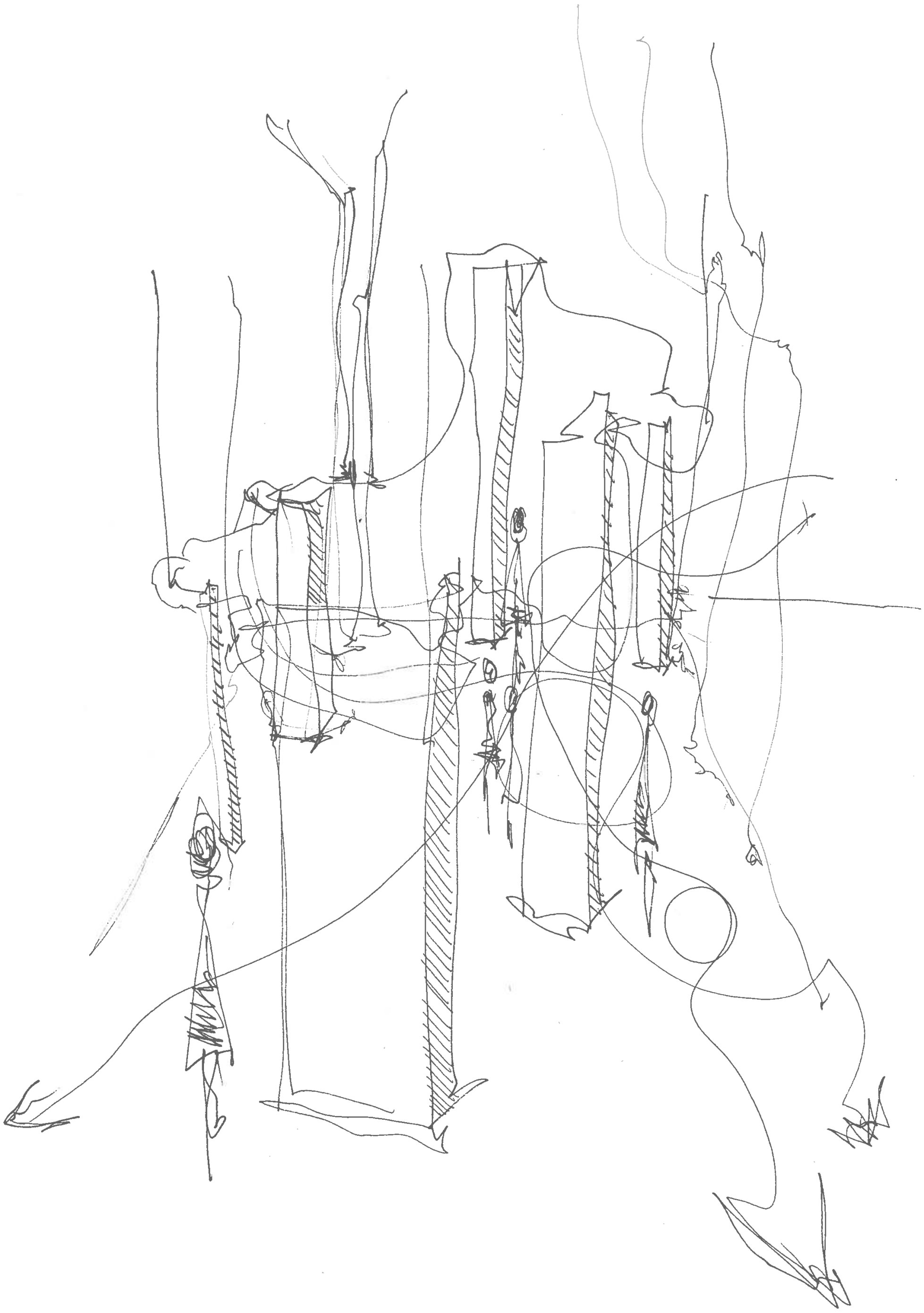
141. The fixed curtain was investigated using lamellers to lighten the expression, but again became an add-on due to the placement only in front of the window.



142. The awning can become an element that, e.g. due to color, can bring a lot of life and character into the building.



143. The awning became an element that characterized the facade and would showcase the life lived behind it.



144. Concept sketch

Promoting,
Positioning,
Presenting,

How Place Mazas ACT, LIVE & BUILD

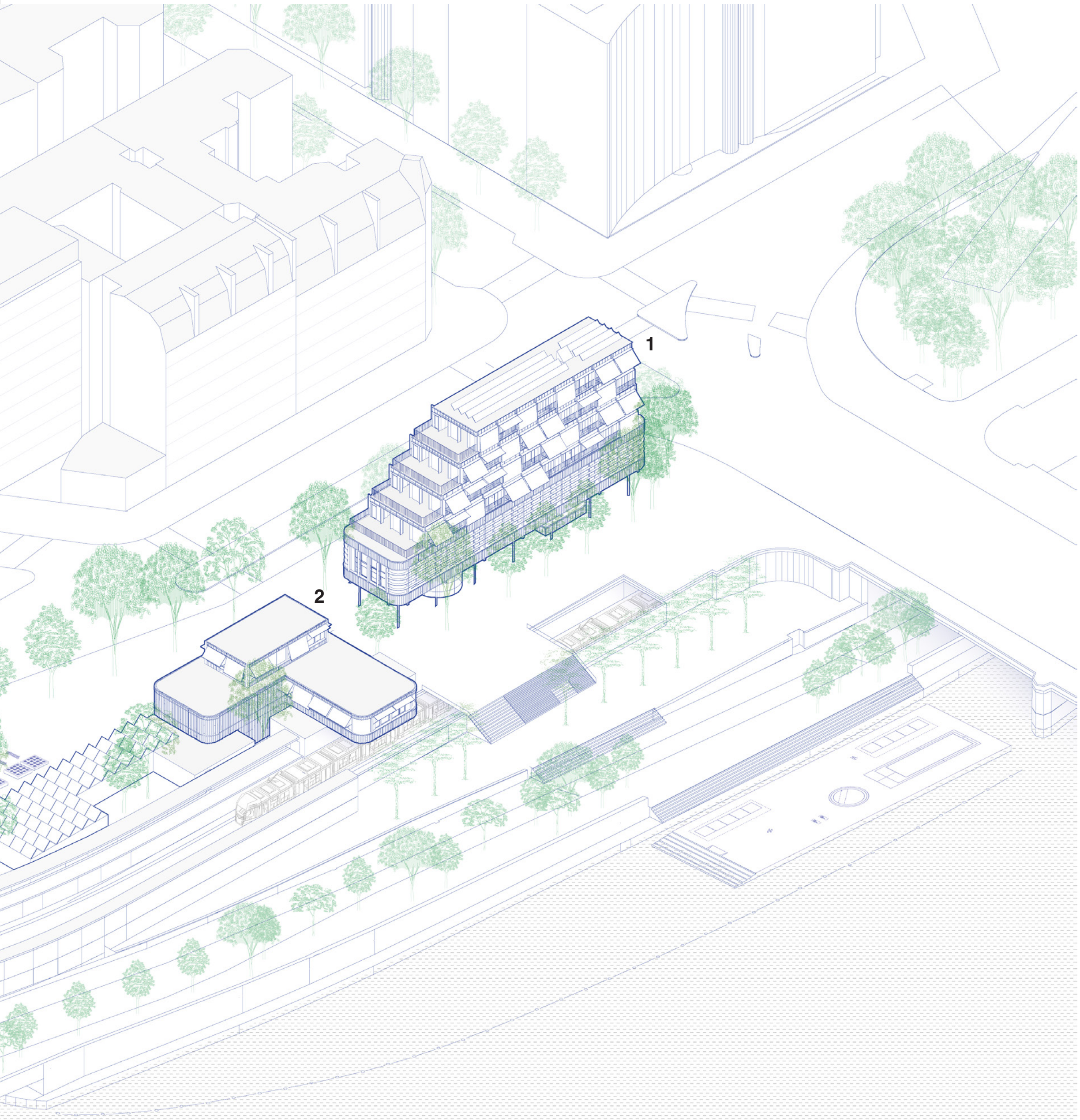
Chapter VIII

Urban scale
The project entangles itself in the complex transition toward the future city of Paris. Through a visionary yet realistic *architectural and technical approach* the project creates the foundation and opportunities for energies on an *urban scale* to meet on a common platform and becomes synergies with the power to inform and change habits suitable for the future life in a metropolis. The project becomes a concretisation of the city's ambitious policy statements toward a better future.

Community scale
The programming of the *New Place Mazas Square* amalgamates social and cultural functions and services to promote and enhance the feeling of community. It combines a diverse habitation scheme with shared functions, hence private and public functions. It becomes a mixed-use area suitable for new modes of living, working, learning and being in the city. A safe and enriching neighbourhood area establishing connections to the surrounding area, which only were to be missing before.

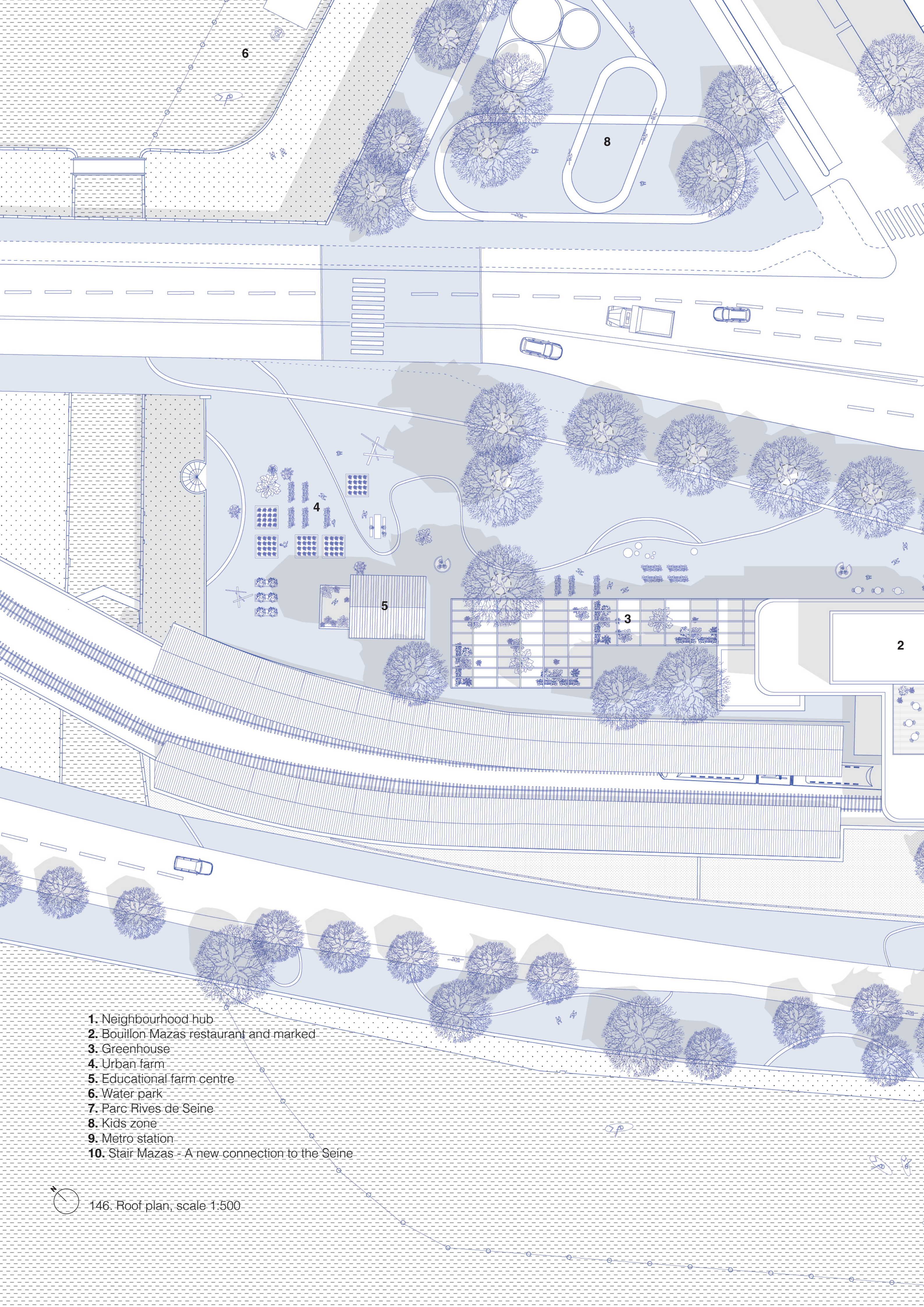
Building scale
The buildings become gentle additions with great respect for the existing yet experimental statement of future needs. The existing qualities and possibilities are enhanced and have been the crux of the matter through the development of the project.

145. Isometric of site



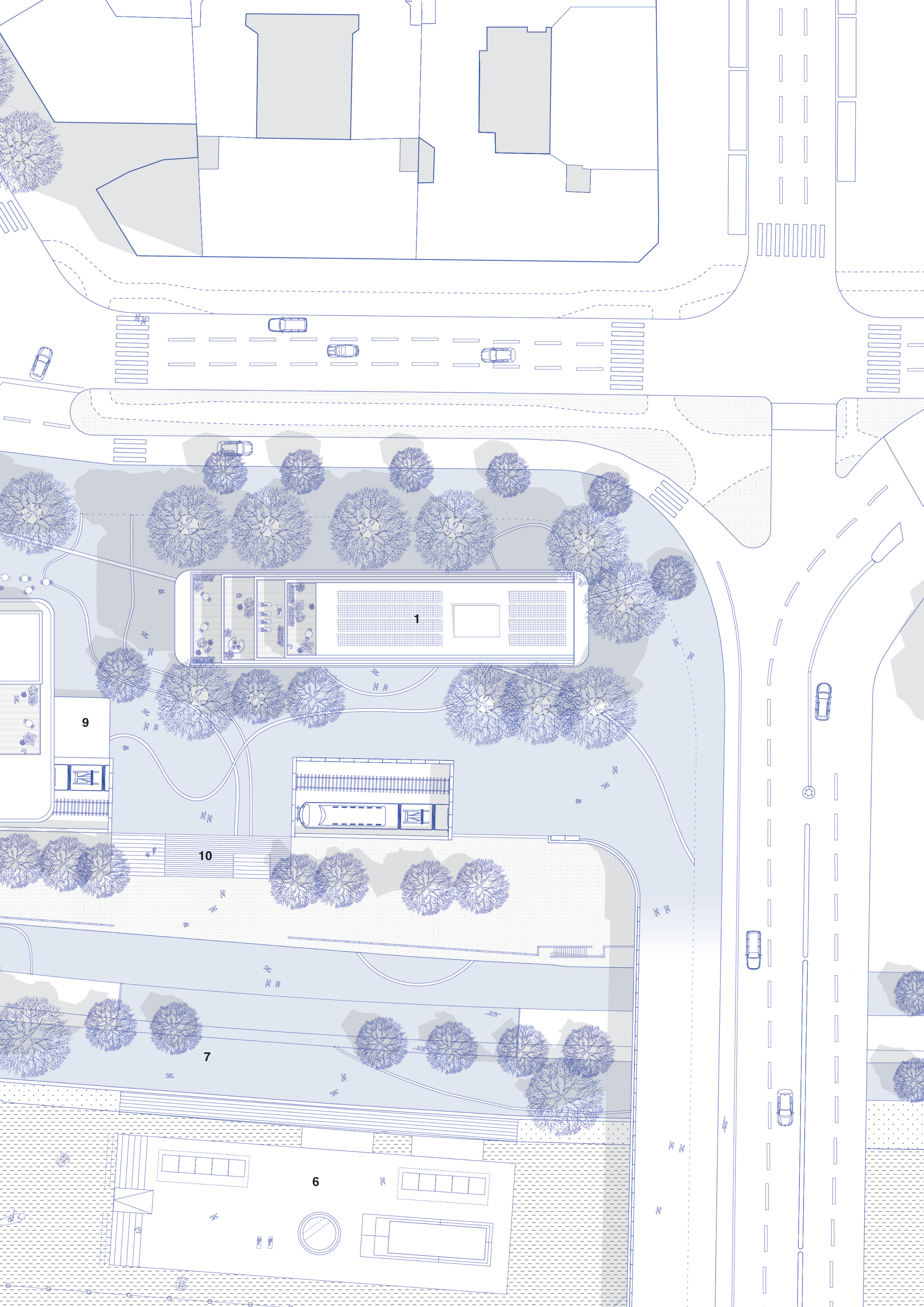
1. Neighborhood Hub
Housing
Shared functions

2. Food Hub
Bouillon resurant
Cooking classes
Greenhouse
Urban farming
Educational farm center

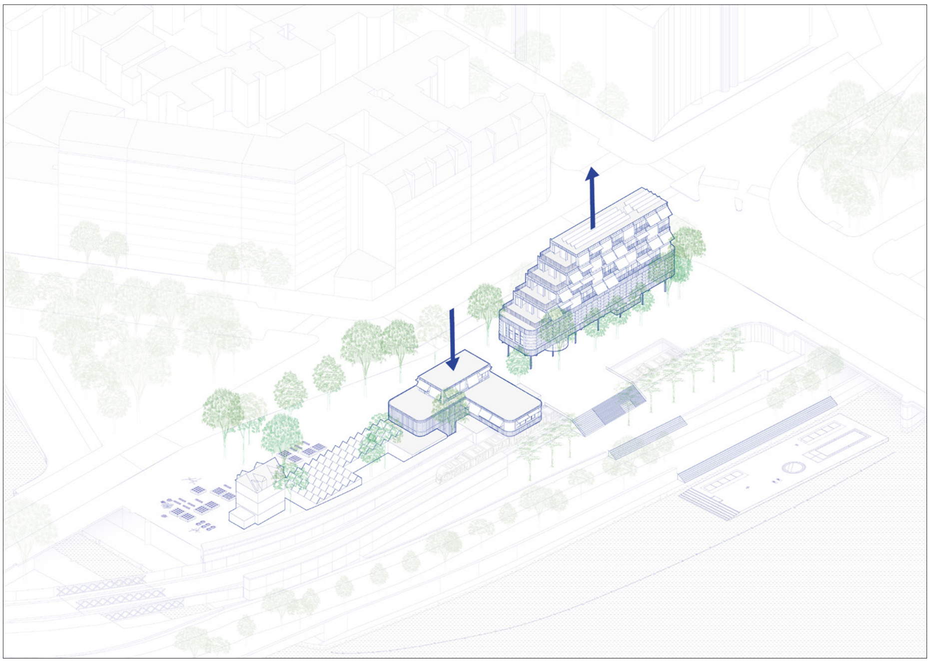


1. Neighbourhood hub
2. Bouillon Mazas restaurant and marked
3. Greenhouse
4. Urban farm
5. Educational farm centre
6. Water park
7. Parc Rives de Seine
8. Kids zone
9. Metro station
10. Stair Mazas - A new connection to the Seine

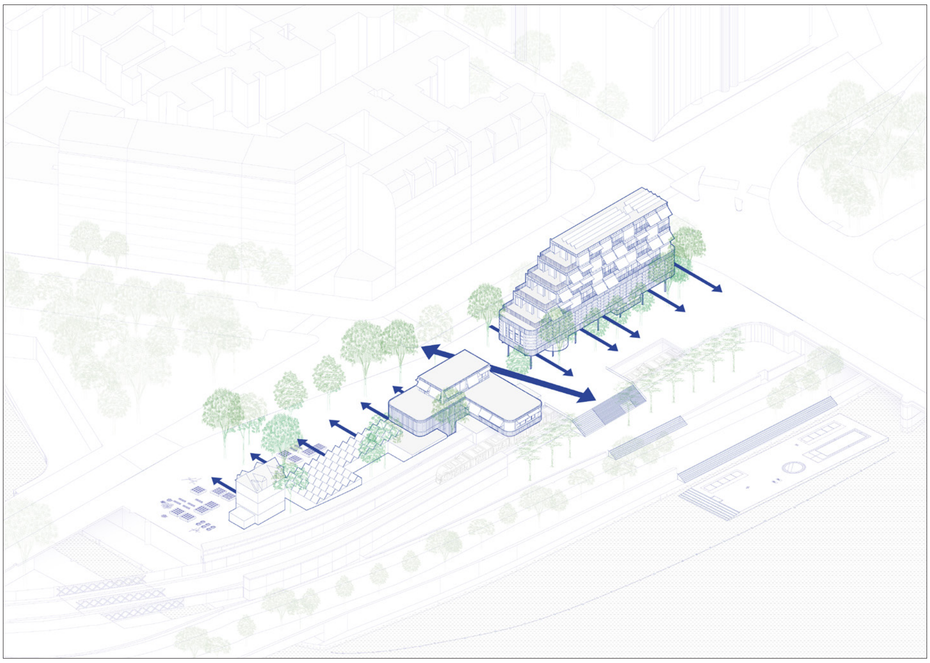
146. Roof plan, scale 1:500


1
9
10
7
6

*The new urban connection ensures the utmost importance of **connectedness** to the near context. It is the crux of the matter for the ecology of the New Place Mazas to promote a resilient urban square and boost social sustainability in the community.*



*With two different concepts, the new building structures become respectful additions. The **Food Hub** positions itself between the existing structures to create coherence. A strong architectural-tectonic approach rises the **Neighbourhood Hub** upon the urban fabric to enhance the people in motion.*



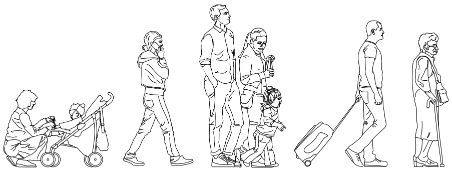
*Place Mazas is reinvented from an urban island to an **accessible** and **inclusive** new square. The programming and positioning of structures create a new link in the city by enhancing different directions.*

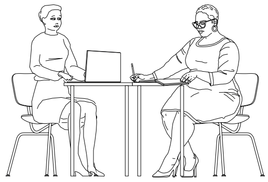
*The New Place Mazas is a **new public gesture to the community**. A piece of architectural quality promoting awareness, accommodating new modes of living for future residents and easing every life and people in motion.*

147. Concept diagrams

A new ecosystem of Place Mazas Square

The everyday life on Place Mazas Square is characterised by two main functions; a ***Food Hub*** and a ***Neighbourhood Hub***, which together create a synergy that encircles the square simultaneously with reaching out to the surrounding city.

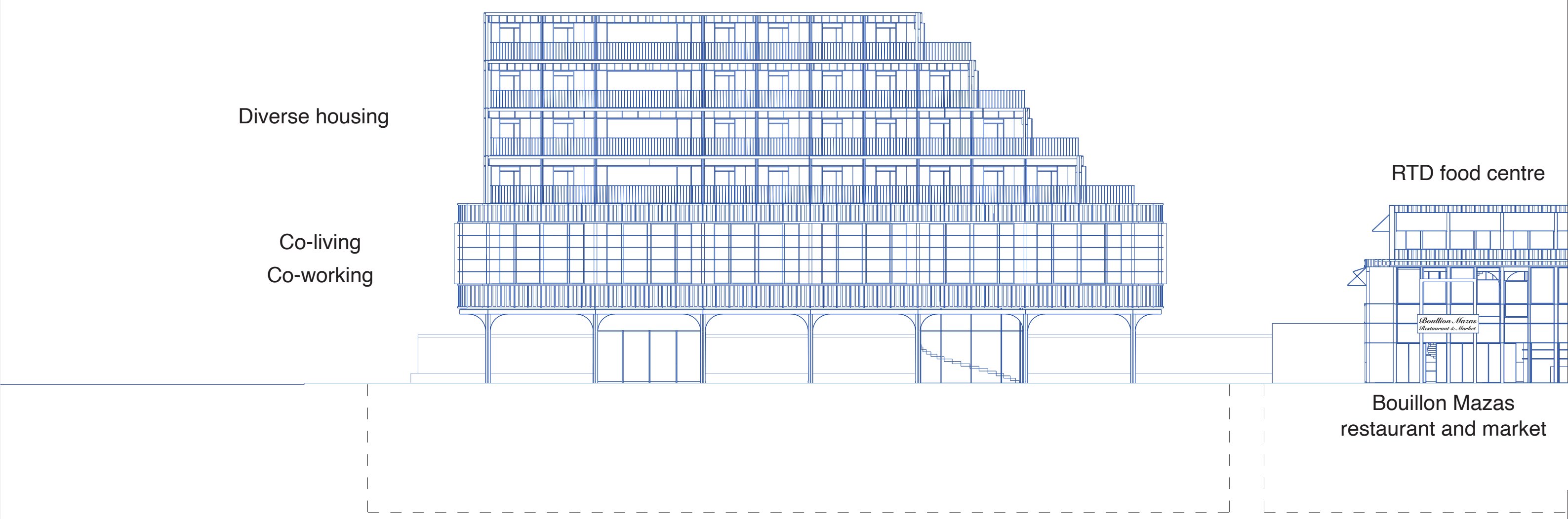




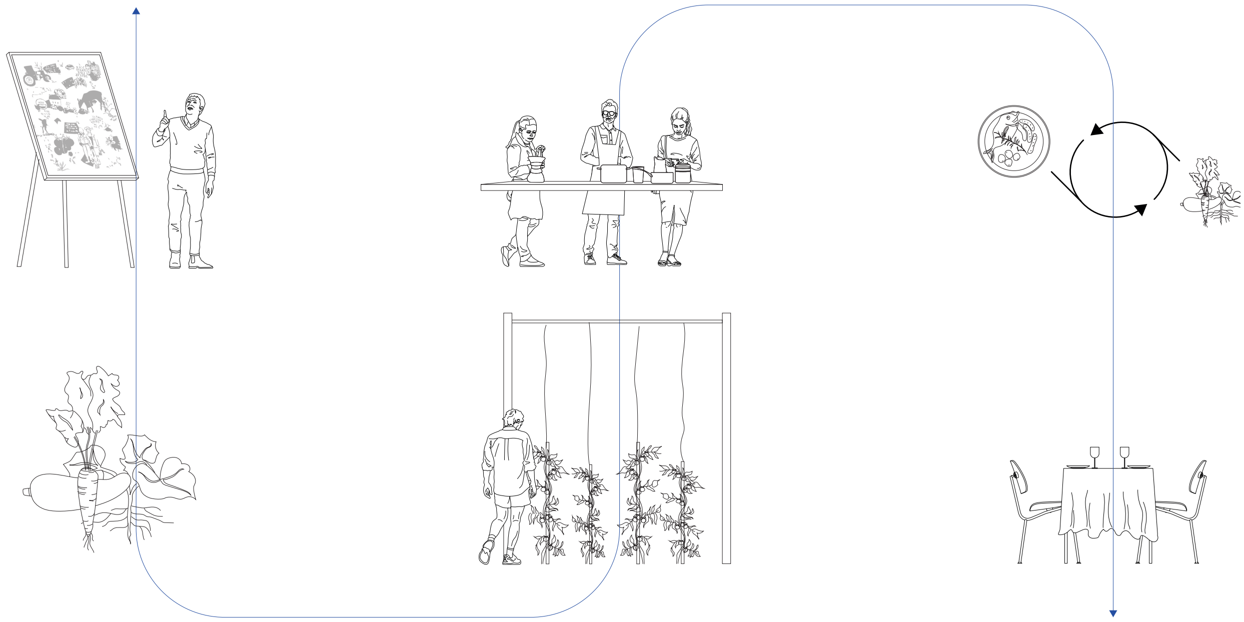
Diverse housing
A variety of apartment types from small guest rooms to three-roomed flats embrace inclusive and diverse housing opportunities with a mix of co-living and shared functions. It is an aim to cope with the future of new modes of living in Paris. It becomes a gentle balance between the individual and the collective community.

Co-living
The Shared spaces provide opportunities to gather as a community. It facilitates common grounds for social gatherings and highlights new standards of pooling and sharing the functions in the city.

Co-working
To grasp the major changes in today's way of working, the first floor is an open work environment for both team work, individual work and teleworking. In that way this facilitates a connection to the whole world and provides both the residents and citizens in the community a comfortable space to work and interact.



148. Princip site elevation north, scale 1:500



Educational Farm centre
This facility functions as an organised *learning centre* and *observatory* for all kinds of users from school classes to interested citizens. This will give access to the old Lock Keepers House, which inevitably has great importance for the collective memory of the square.

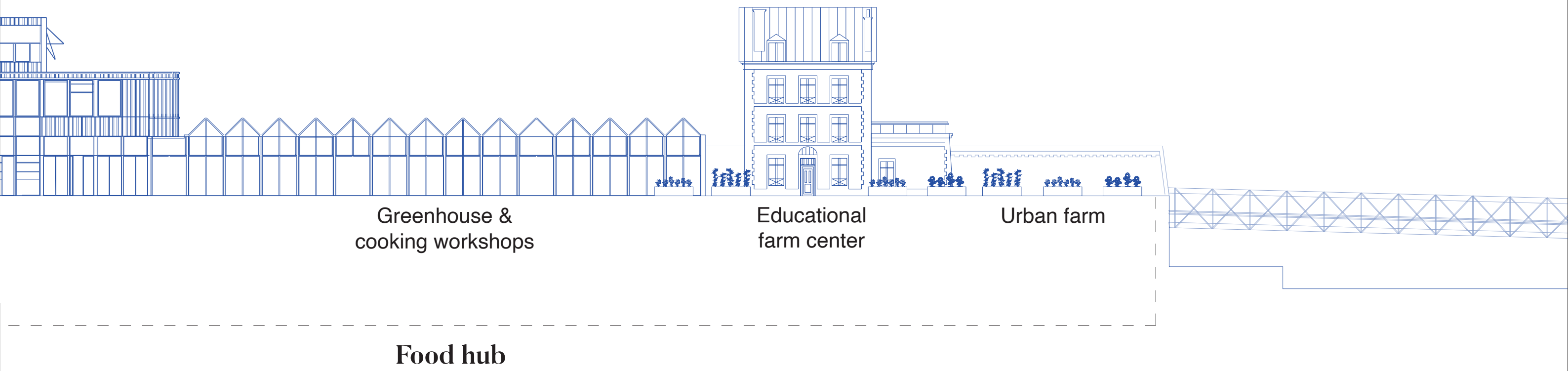
Urban farming
The Urban farm provides not only fresh vegetables to the *Bouillion restaurant & market* and *cooking workshops*, but becomes a *public learning centre* following the principle of learning by doing through experiences. It has the possibility to be an explicit and visual first sod to increase awareness and change habits toward a Sustainable Food City.

Greenhouse
By transforming the wretched brick-building into a greenhouse it becomes the link between food production and the Bouillon. It is in free access to the market and restaurant and has the potential to open fully to the public during events and venues to increase the awareness of food production in the heart of the city.

Cooking workshops
In combination with the kitchen serving the restaurant, it is possible to host cooking workshops, which becomes the next step on the learning curve. From raw vegetables to healthy food.

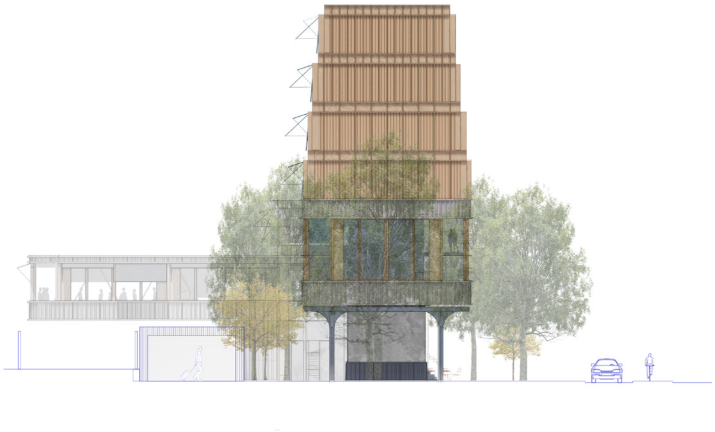
RTD food centre
The Bouillon is functioning by the administration of a new *Recovery Transformation Donation food centre*. The vision is to collect unsold food from all around the city to serve or distribute it to other places with concepts like the Bouillon Mazas.

Bouillion Mazas - Resurant & Market
A sustainable and affordable *Bouillon Restaurant & Market* becomes the crowning glory of the *Food Hub eco-system*. Priority number one is to serve healthy and affordable food for the neighbourhood and visitors with the statement; '***better food for more people'***. With an ambitious concept of serving not only food from the urban farm and greenhouse but unsold food from all around the city through a *Food Recovery scheme*, the Bouillon has the potential to place Place Mazas on the city map.



The facades tell a story of translation, new perspectives and inspirations from the past. ***Steel***, used as a load-bearing structure in some of the buildings, is chosen, among others, as a comment on Paris' history of steel constructions. ***Wood*** is chosen as a sustainable initiative creating a statement and a new way of building among the characteristic Haussmann buildings. The layering and rhythm of the facade are created as a translation of the investigated Parisian context, with its distinguished *head-body-base* principle.

149. Facade elevation south-east, scale 1:500



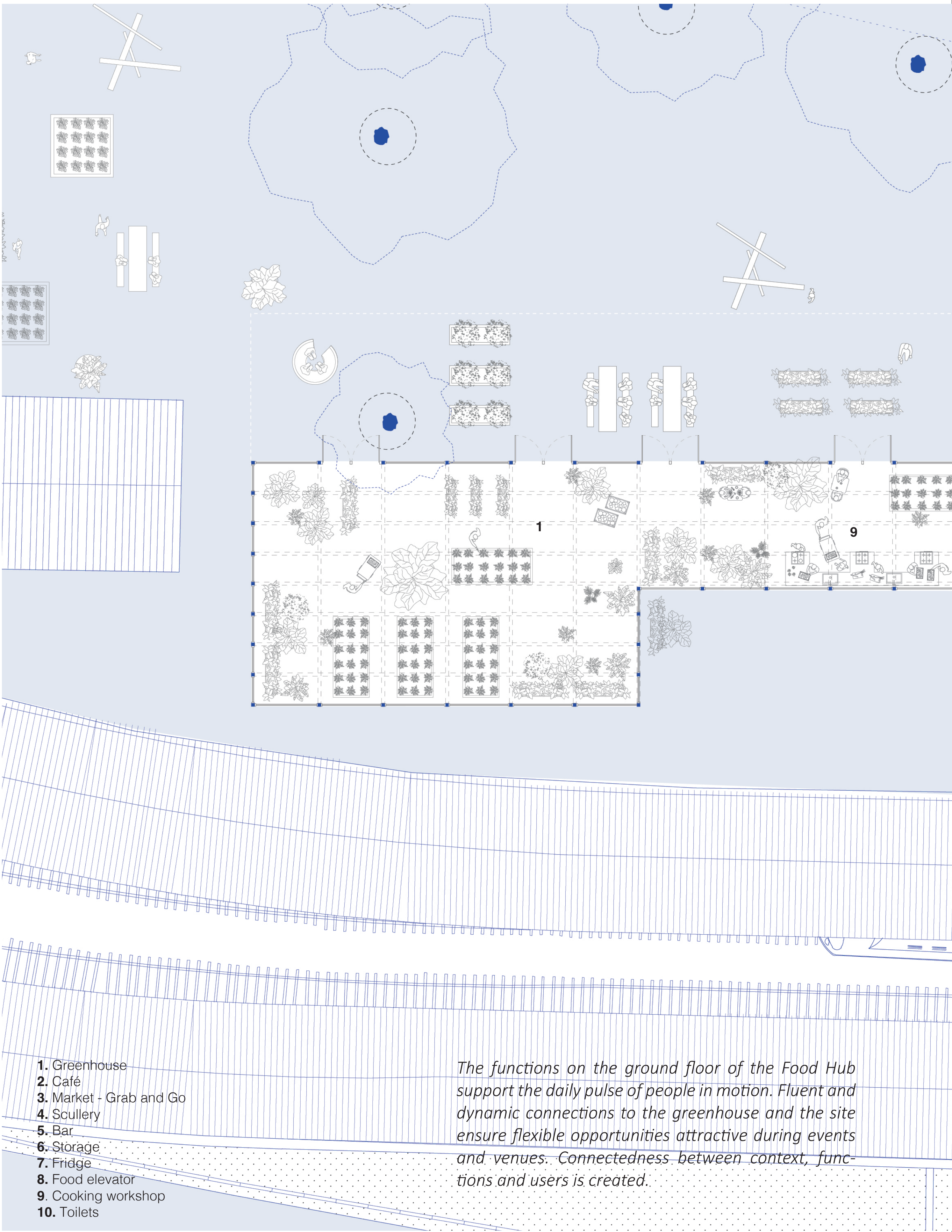
150. Facade elevation south-east, scale 1:500

151. Facade elevation south-vest, scale 1:500

152. Facade elevation north-west, scale 1:500

153. Facade elevation north-west, scale 1:500

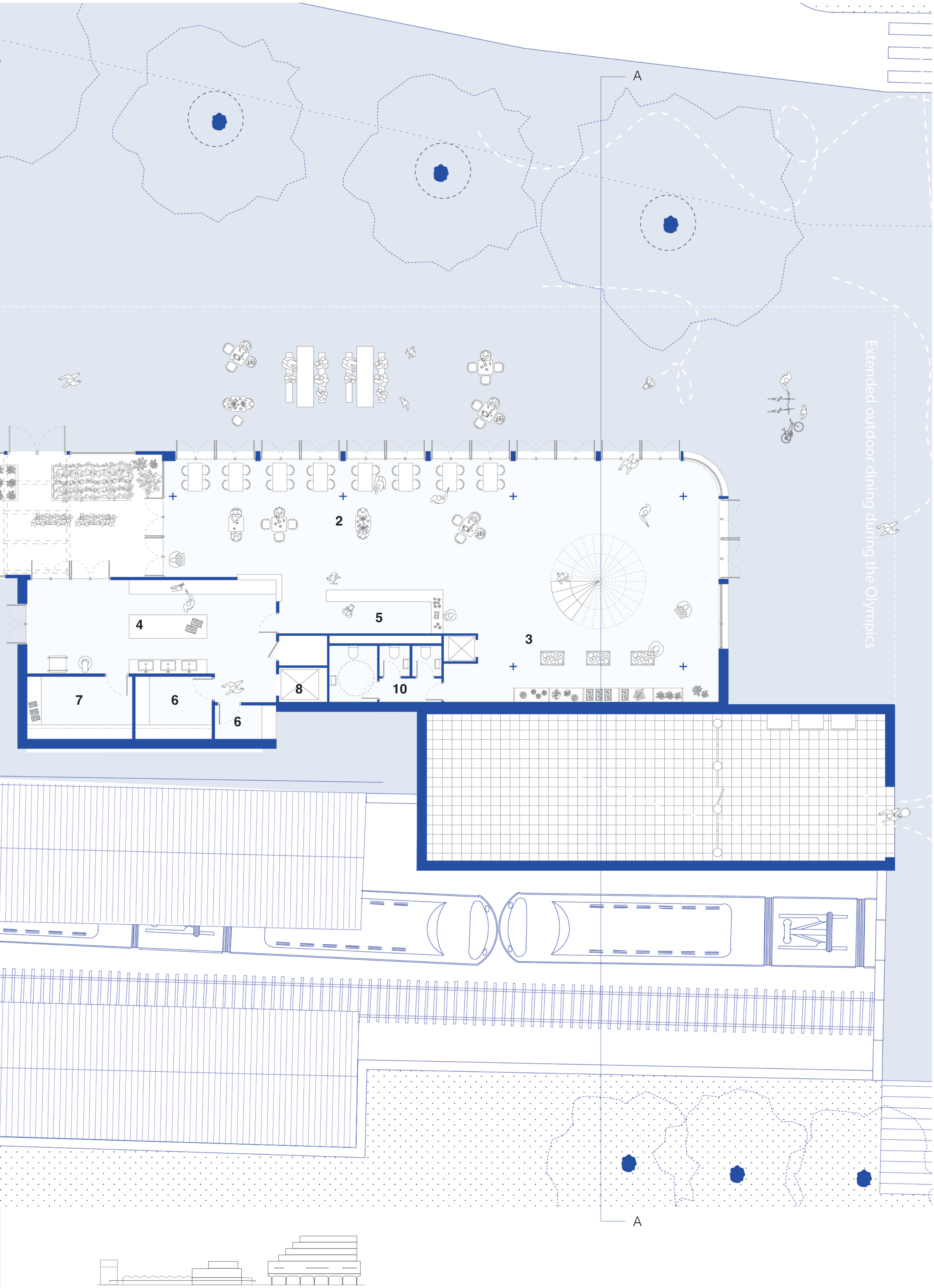
154. Facade elevation north-east, scale 1:500

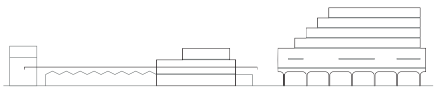


1. Greenhouse
2. Café
3. Market - Grab and Go
4. Scullery
5. Bar
6. Storage
7. Fridge
8. Food elevator
9. Cooking workshop
10. Toilets

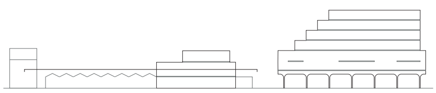
The functions on the ground floor of the Food Hub support the daily pulse of people in motion. Fluent and dynamic connections to the greenhouse and the site ensure flexible opportunities attractive during events and venues. Connectedness between context, functions and users is created.

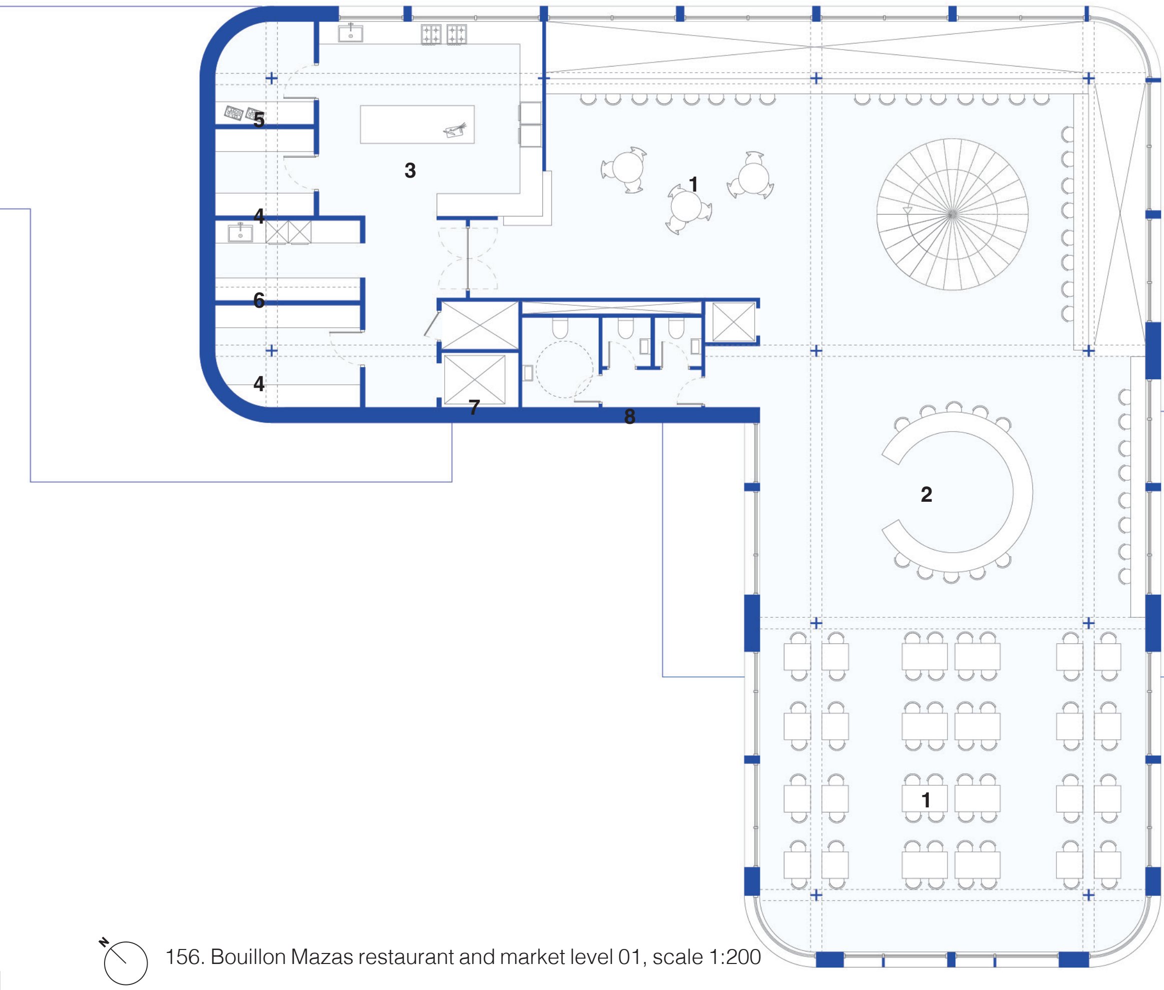
155. Food Hub level 00, scale 1:200


A
Extended outdoor dining during the Olympics
2
4
5
3
7
6
6
8
10
A

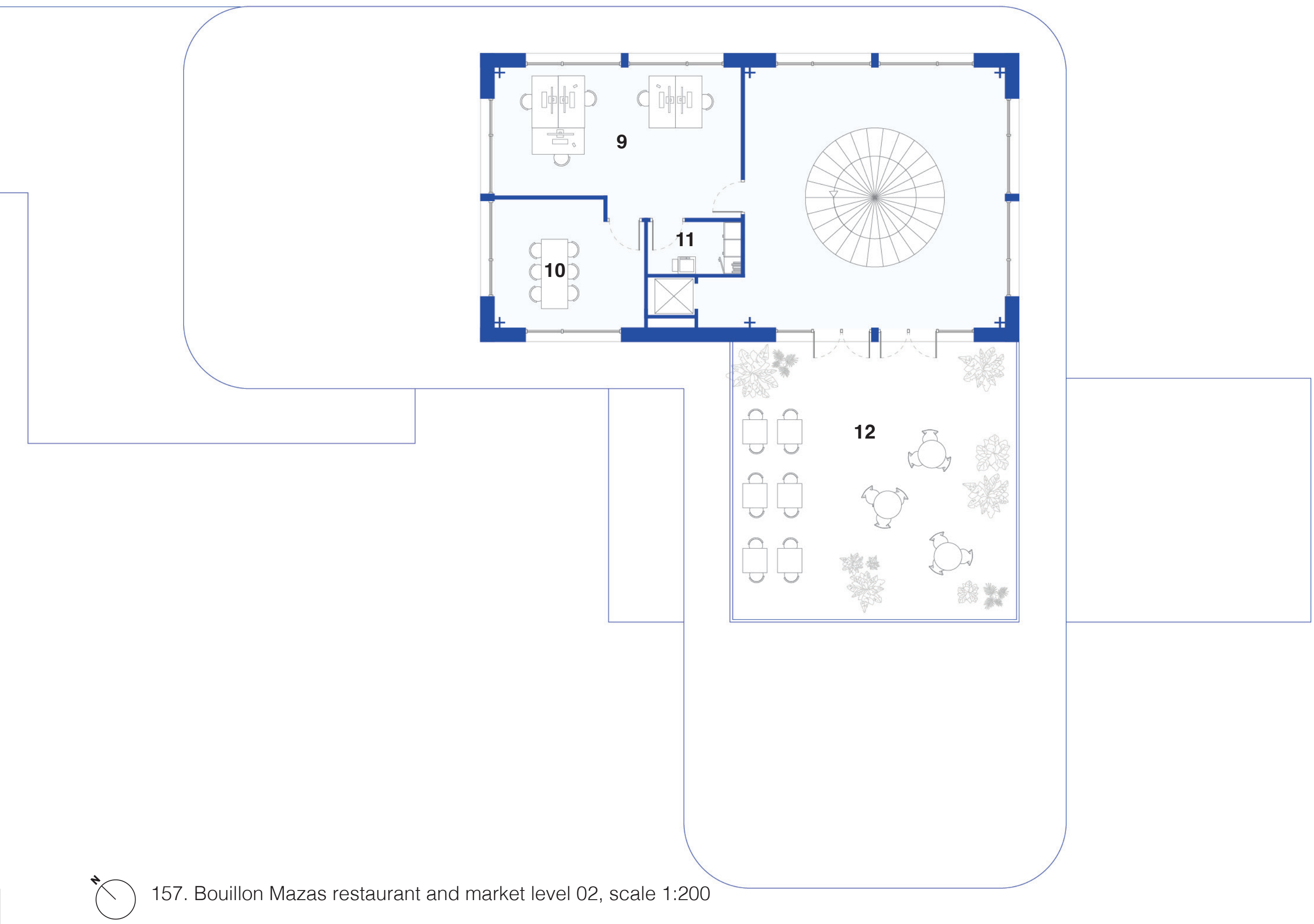


1. Bouillon restaurant
2. Bar
3. Kitchen
4. Storage
5. Fridge
6. Dish was
7. Food elevator
8. Toilet
9. Office
10. Meeting room
11. Storage
12. Terrasse

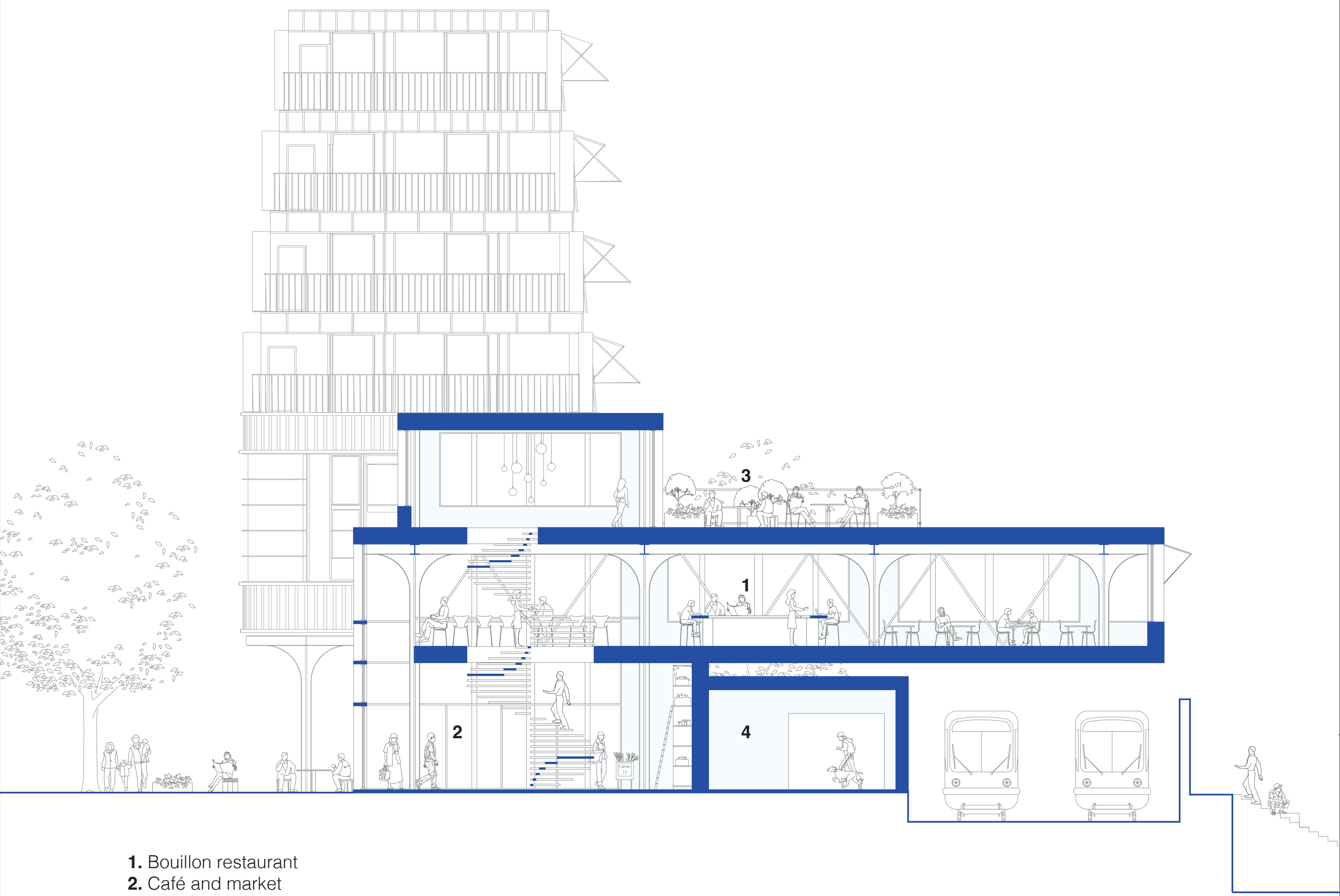




156. Bouillon Mazas restaurant and market level 01, scale 1:200



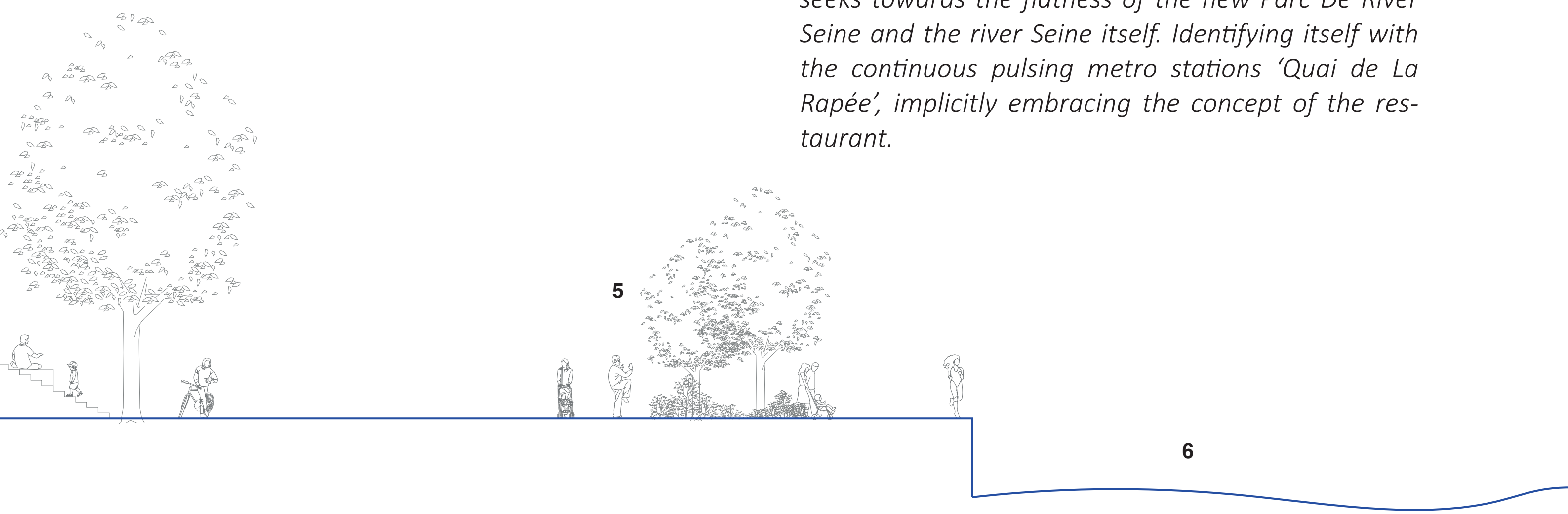
157. Bouillon Mazas restaurant and market level 02, scale 1:200

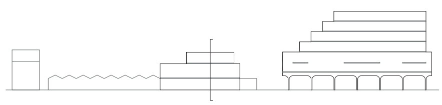


1. Bouillon restaurant
2. Café and market
3. Terrasse
4. Metrostation
5. Parc De River Seine
6. River Seine

158. Bouillon Mazas restaurant and market section AA, scale 1:200

Hovering above the metro station, seeking towards the river Seine, with its body sturdy planted and rooted in the New Place Mazas square, the Bouillon Mazas restaurant and market positions itself. Creating a graceful gradient in volume and height the building responds to the height of the Neighbourhood Hub and seeks towards the flatness of the new Parc De River Seine and the river Seine itself. Identifying itself with the continuous pulsing metro stations 'Quai de La Rapée', implicitly embracing the concept of the restaurant.

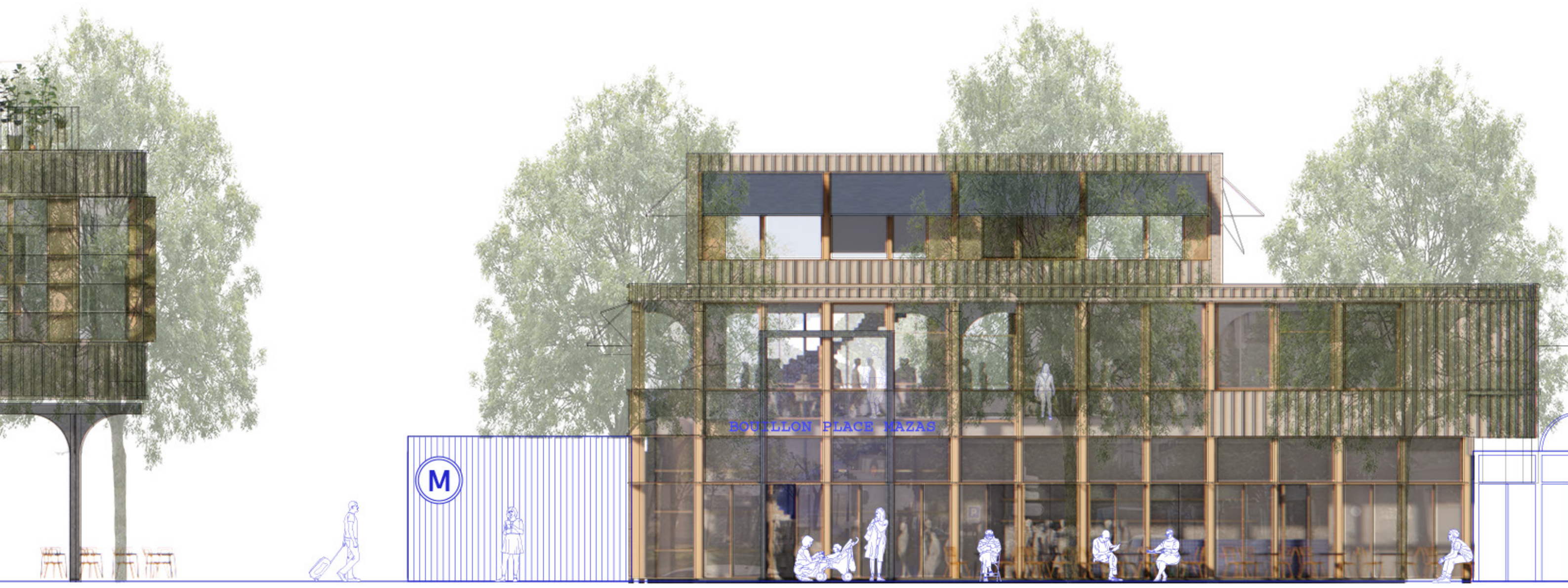




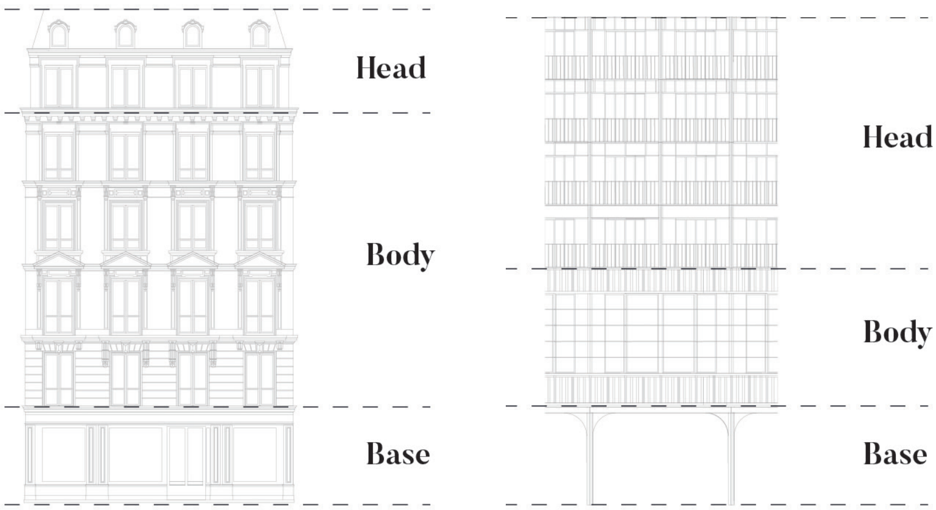
With great glazed facades opening up to the site and the city, by-passers and neighbours are invited into an ecological world of sustainable conscious food. The New Place Mazas and the Food Hub explore the magnificent food scene of Paris and demand new initiatives. Elegantly raising the Neighbourhood hub on steel columns creates an open and inviting square to both take a pause and exhale as well as leading the pedestrians to the river Seine and allowing free views.

159. Visualisation of the connection between the Food Hub and the Neighbourhood Hub

160. Facade elevation north-east, scale 1:200

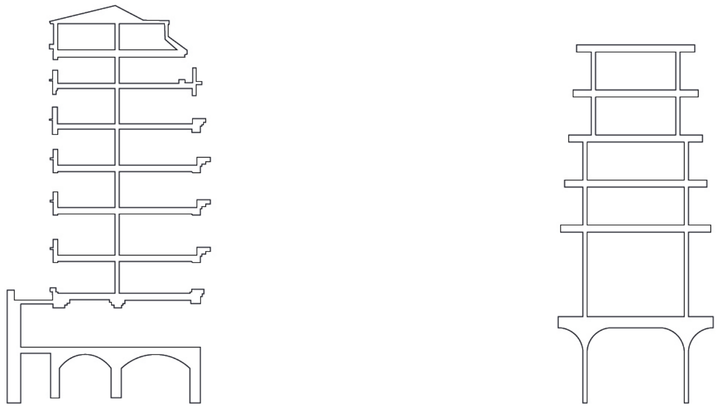

BOUILLON PLACE MAZAS
M

The proud tradition of using iron in architectural structures is implemented in the project. The steel makes it possible to use less material while carrying a heavy load. The iron constructions, often with many details and ornaments, have been translated into a more modern, simple construction.

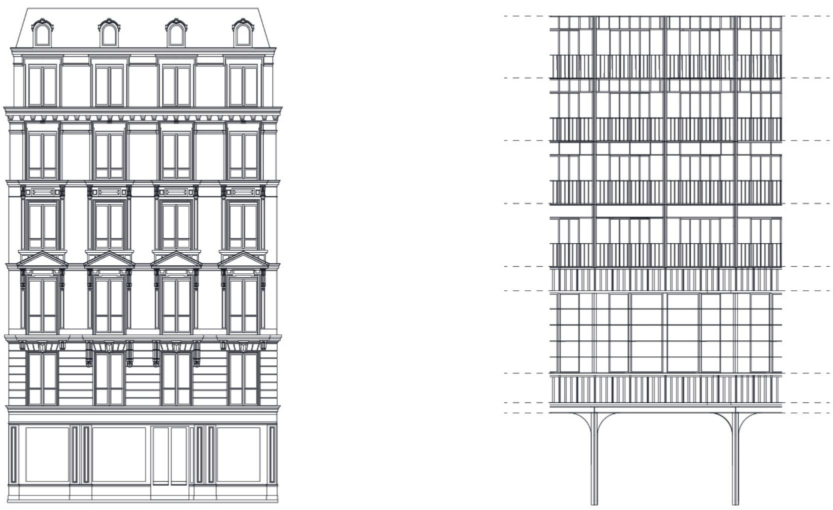


The *head-body-base* principle characterising the Haussmann architecture of Paris has been translated and used as a principle for the organisation of the *Neighbourhood Hub*. The *base as the city*, the *body as the functions we share*, and the *head as our private dwellings*.

161. Examples of translations

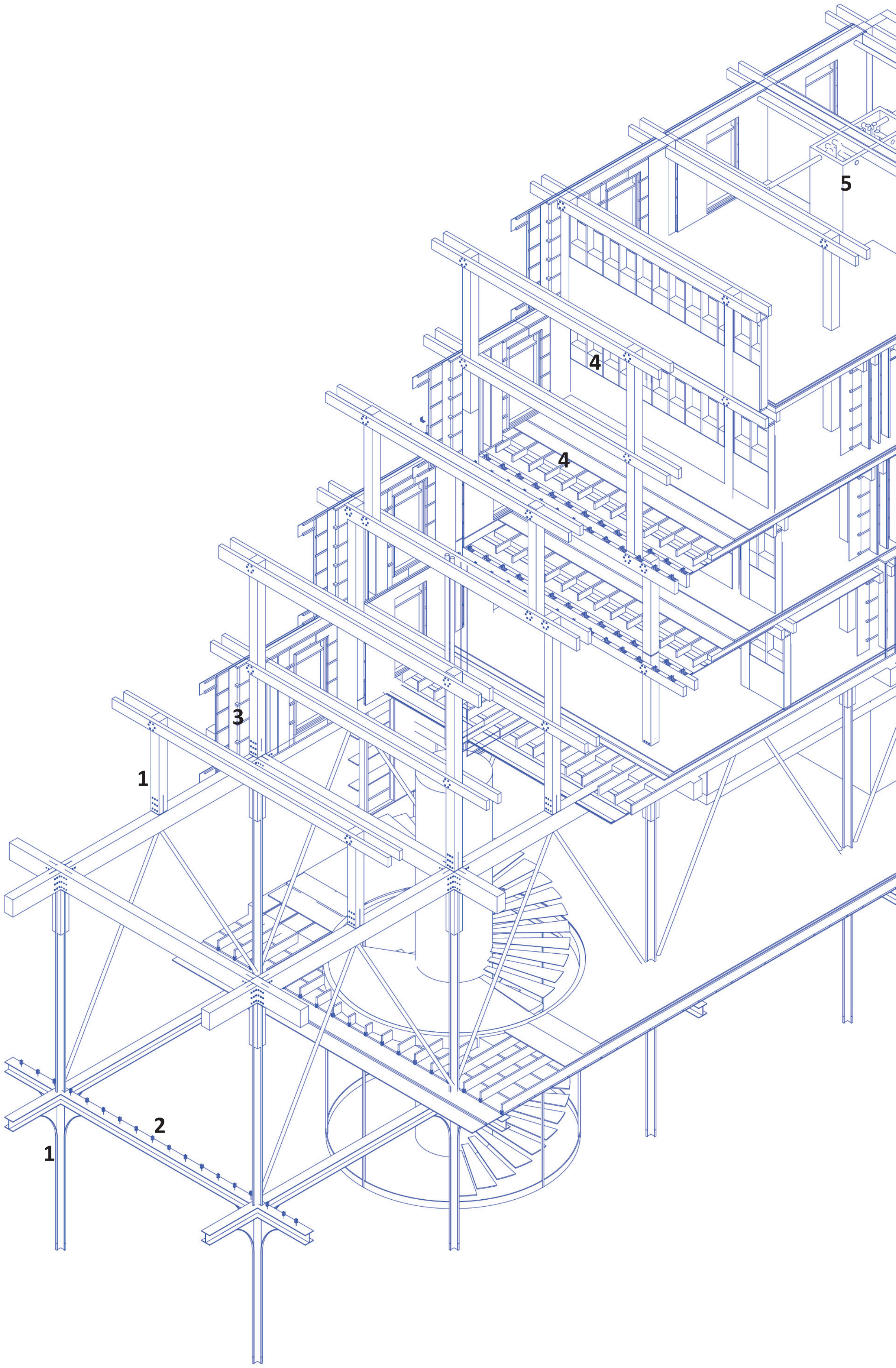


The simple construction principles of the Haussmann building blocks are translated into the project. The iconic section gets a new, modern interpreted expression.

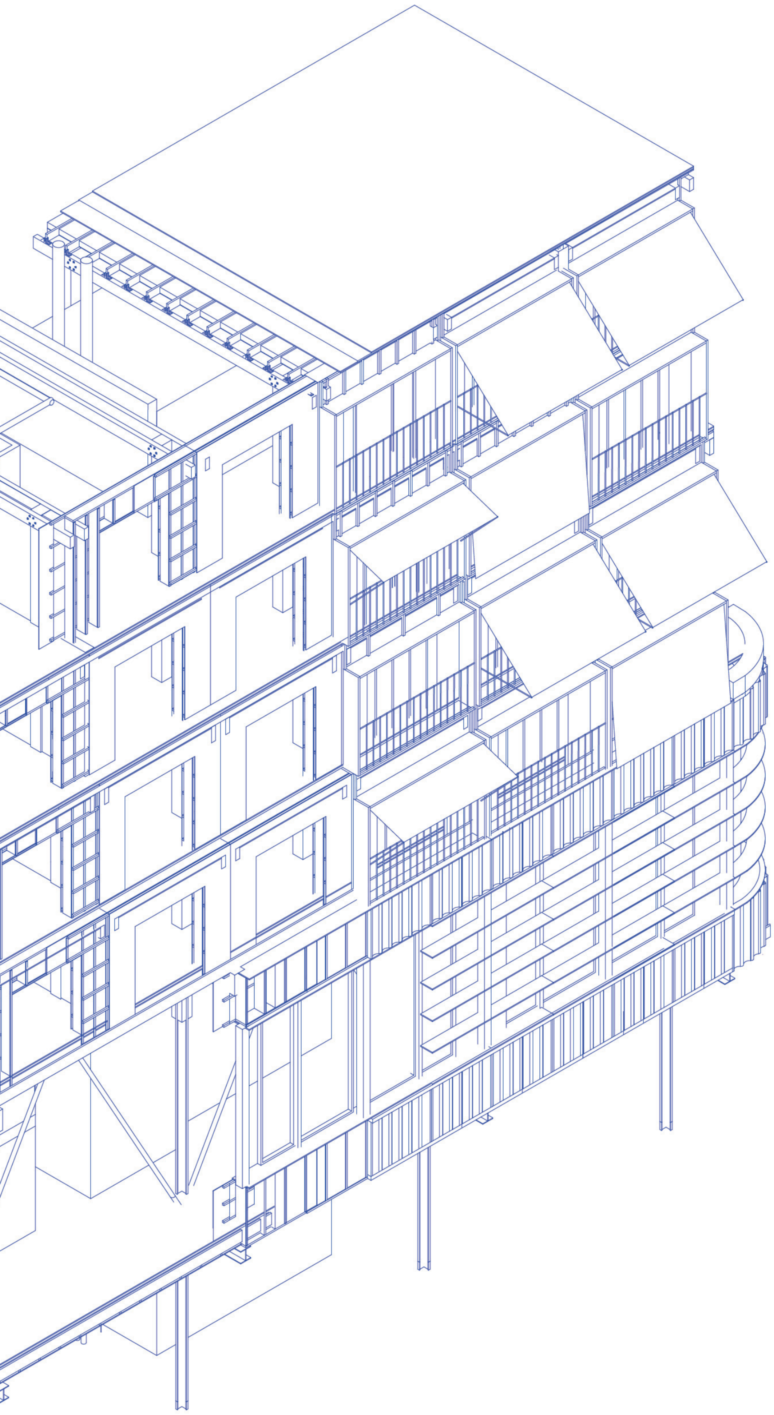


In a fusion between interior functions and the outer expression and perception of layering, materiality and depth the facade design becomes an interpretation of the existing *Collected Language* of Paris.

162. Examples of translations



163. Isometric of tectonic and technical principles

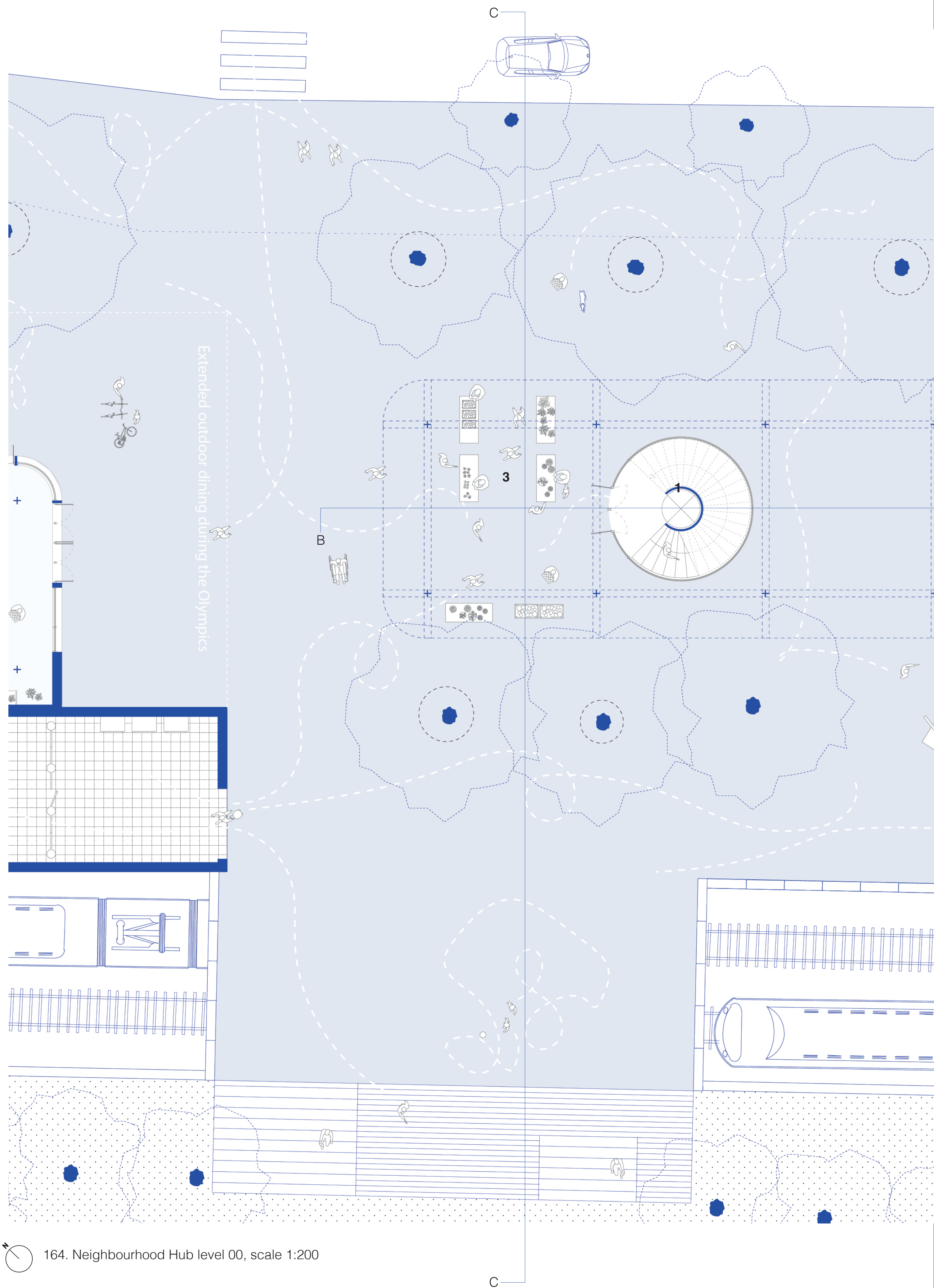


Constructing and construing the Neighbourhood hub A telling of tectonics.

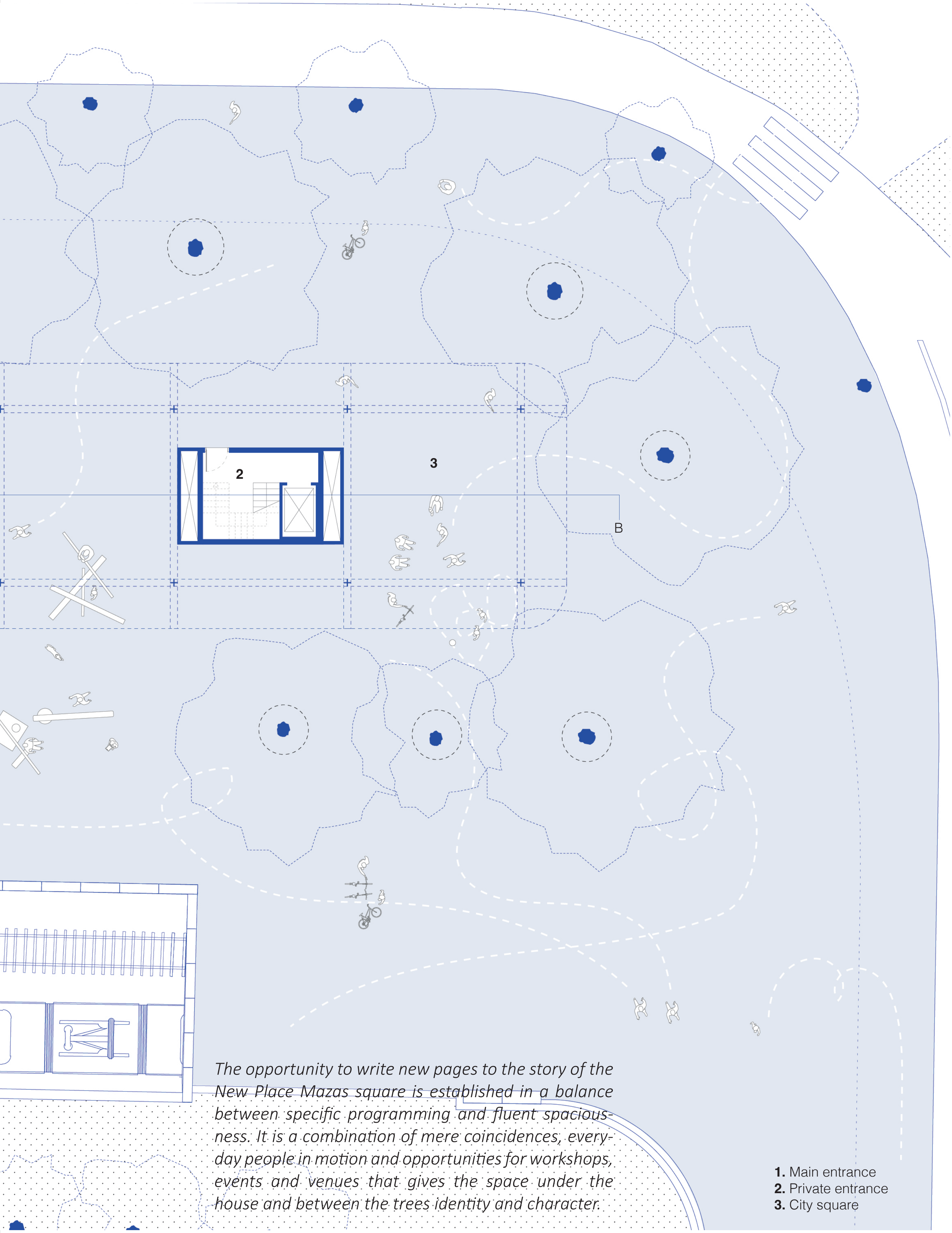
The tectonics of the building enhances the ecology between functions by carefully chosen materials, joints and arrangement of structural elements all evaluated to their unique presence in the overall structural principle of the house.

The steel frame structure in the bottom entails greater spans intensifying the public functions by creating an open, inviting and flexible experience. The wood-frame structure on the top addresses a change in function. The materiality, shorter spans and joining enables the inhabitant to encounter a completely different atmosphere speaking towards the creation of a home.

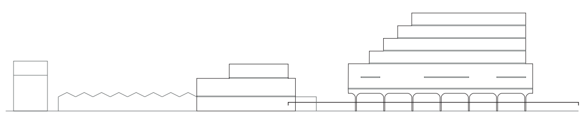
1. The load-bearing frame structure of steel on Level 00-02, carries the heavy load of the bearing timber-frame structure on Level 03-07.
2. Lifting the building envelope in the bottom from the steel beams minimises cold bridges and creates an expression of a light building.
3. The building envelope is constructed in cross insulated lightweight timber frames.
4. The horizontal and vertical divisions are constructed in lightweight timber frames with fire-safe insulation.
5. The technical installations are led inside the timber frames and through the technical cores. Each technical core contains ventilation systems, water supply electricity and district heating.

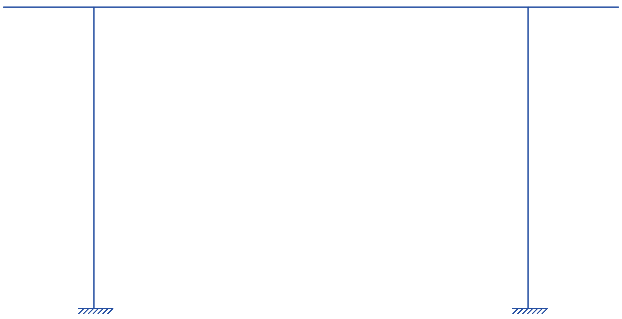


164. Neighbourhood Hub level 00, scale 1:200

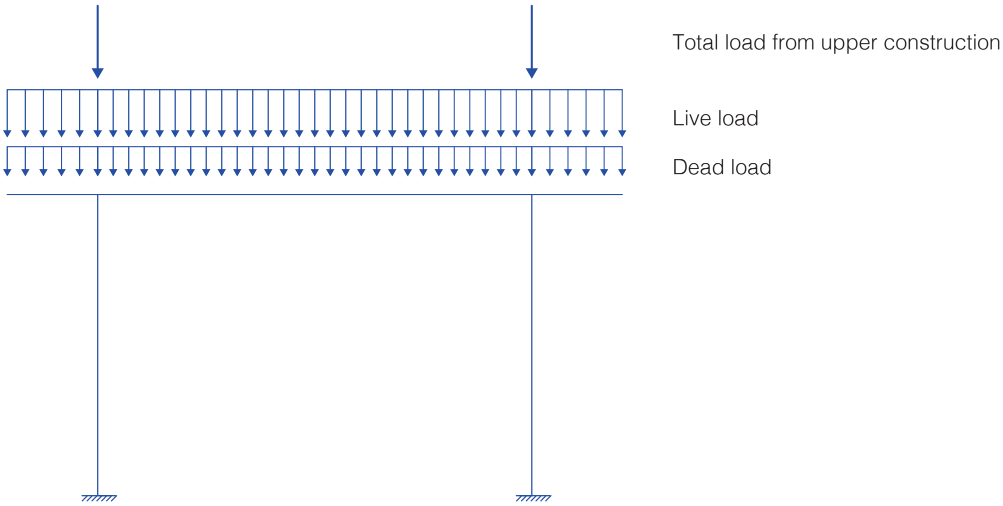


The opportunity to write new pages to the story of the New Place Mazas square is established in a balance between specific programming and fluent spaciousness. It is a combination of mere coincidences, everyday people in motion and opportunities for workshops, events and venues that gives the space under the house and between the trees identity and character.

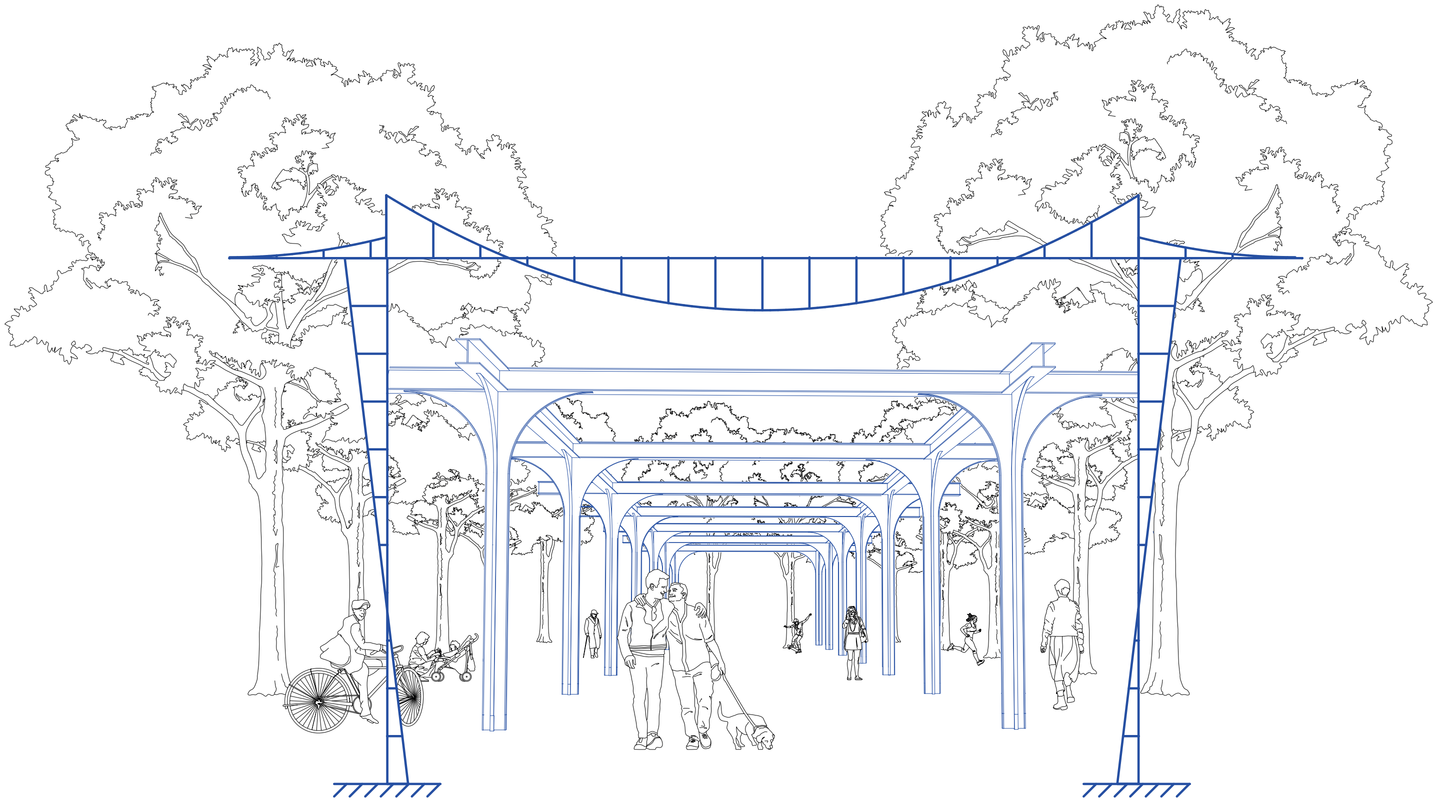




165. Free body diagram



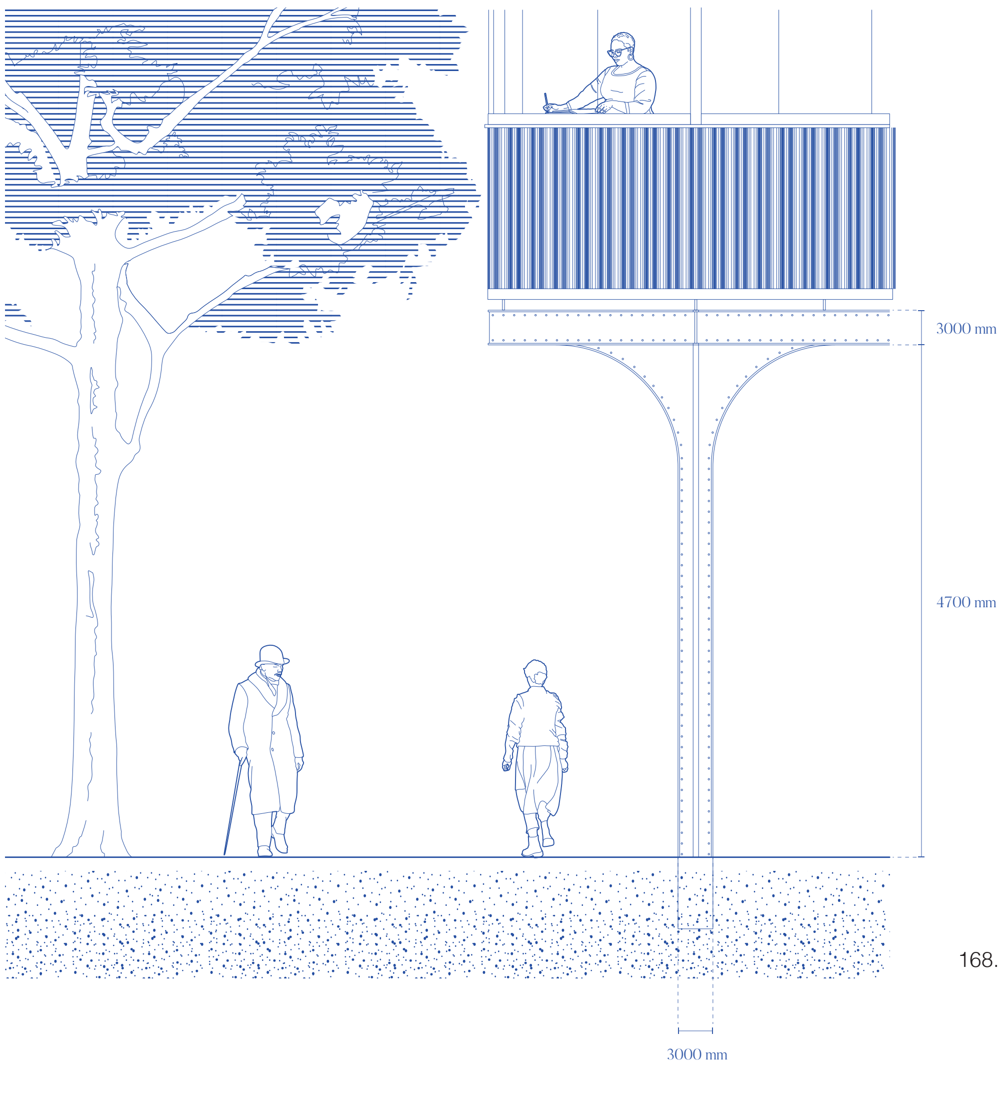
166. Free body diagram with loads



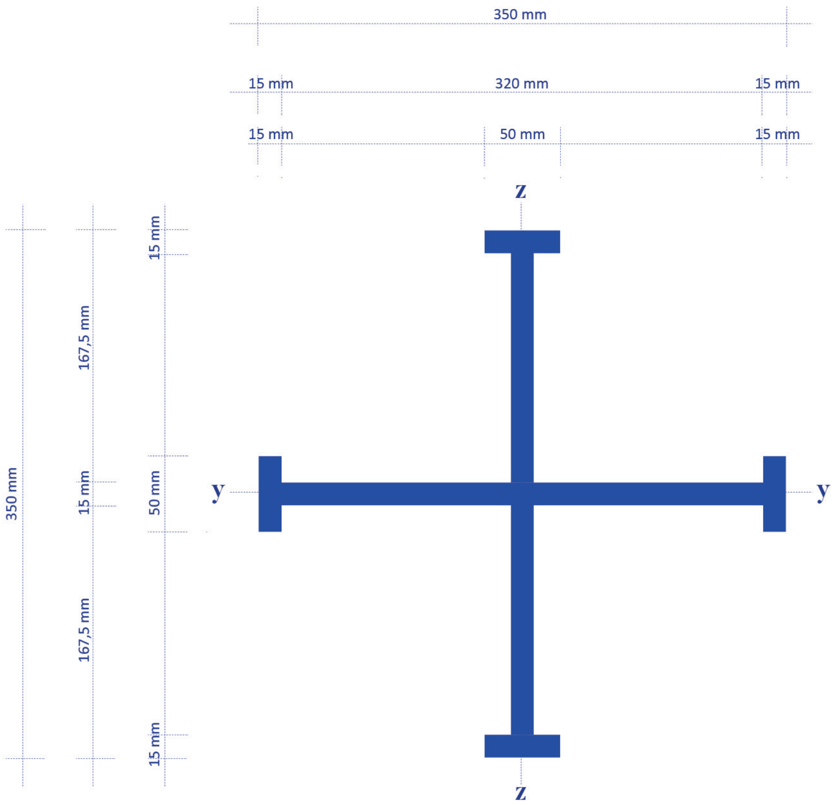
167. Moment curve

The two columns and the overlaying beam create a frame with rigid joints (Illu. 164). The dead load and live load on the construction lie as a line load on top of the beam. The load from the upper floors is led directly through the columns as two point loads (Illu. 165). (See appendix A). The free-body diagram and the loads result in a ***moment curve*** *(Illu. 166) where it is visible that more material is needed in the joint between the column and beam.*

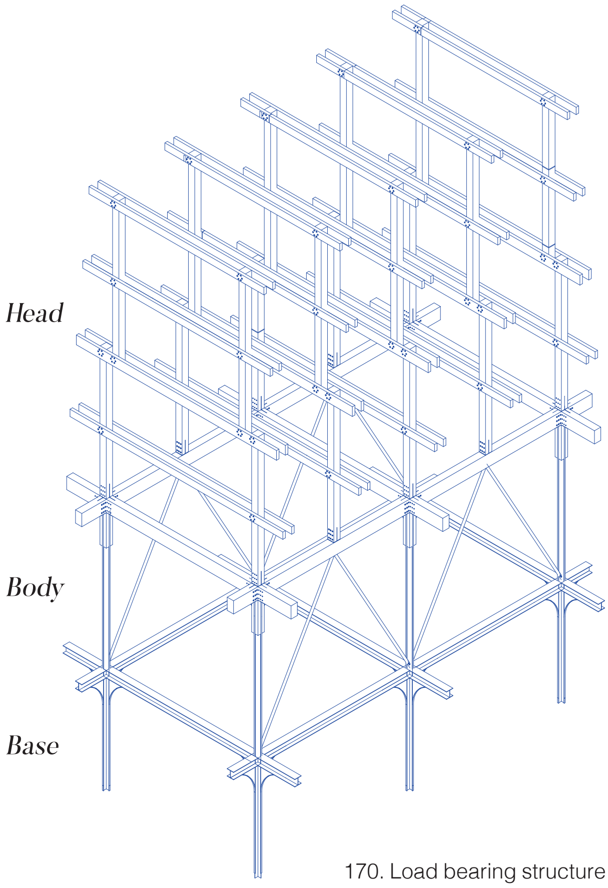
The building is lifted from the ground with columns that are designed with direct inspiration from the ***moment curve*** *and* ***forces*** *and the contextual* ***trees****. The* ***height****,* ***arches*** *and* ***arrangement*** *of the columns tell a story of constructive principles intensifying the space under the trees while the building is hovering over the people in motion.*



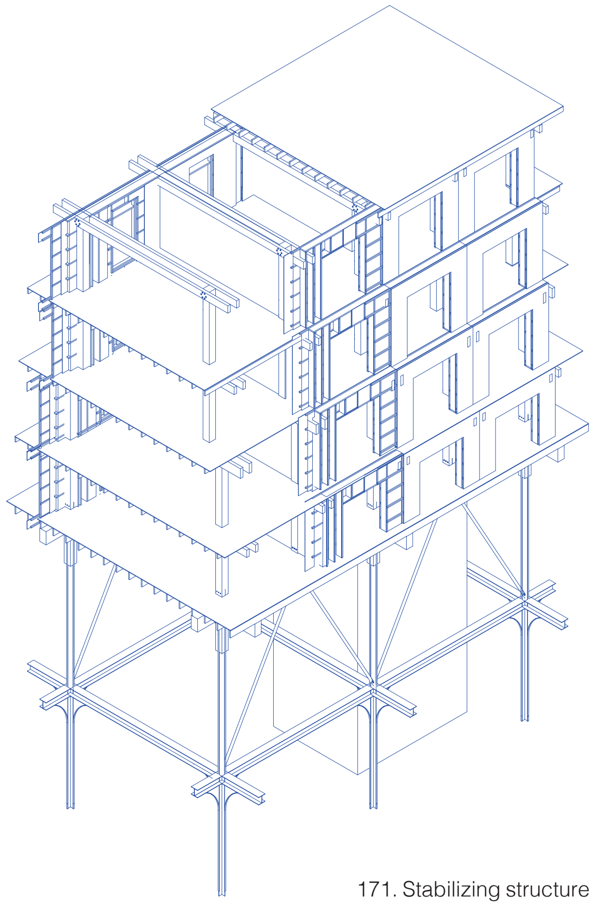
168. Spatial experience



169. Cross section of column



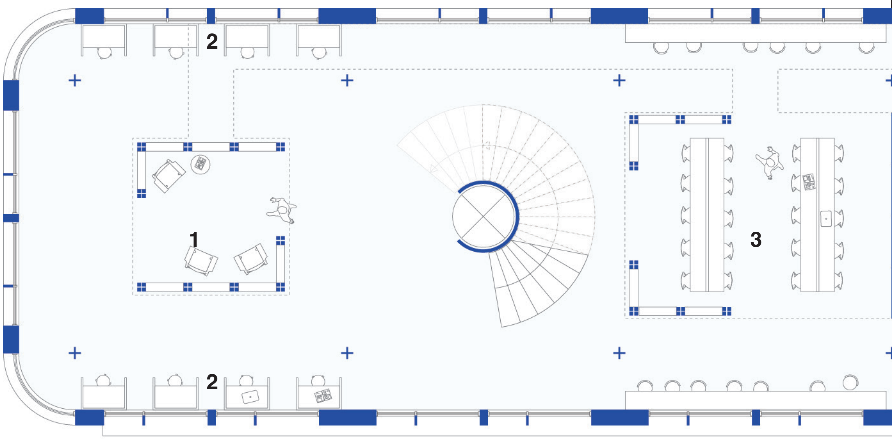
170. Load bearing structure



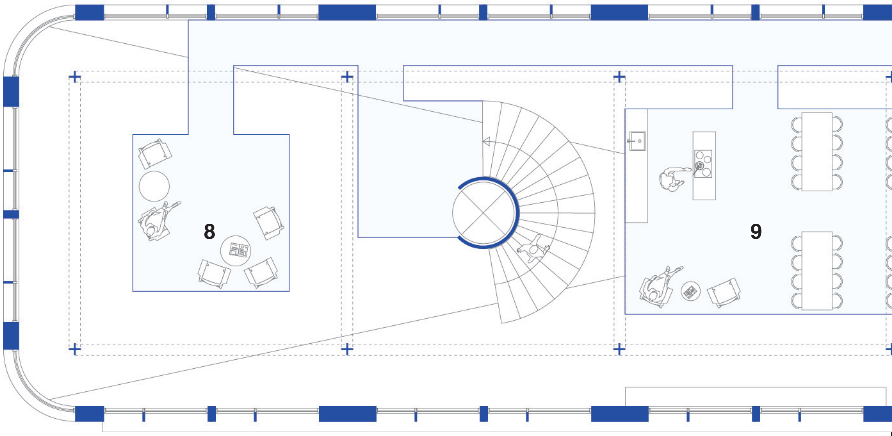
171. Stabilizing structure

The load-bearing structure in the ***base*** *is constructed with rigid joints in the steel columns and beams. The* ***body*** *is constructed as a large truss beam where the columns and struts are arranged to lead the applied loads down to the bottom columns. The* ***head*** *is constructed in wooden rigid jointed frames.*

Since the base and the body are fixed in both axes they are stabilized by the rigidity of the joints and create a ***Portal Frame Lateral Stability System****. The head is stabilized by wooden floors and walls and the concrete core functioning as a* ***Wall Lateral Stability System.***



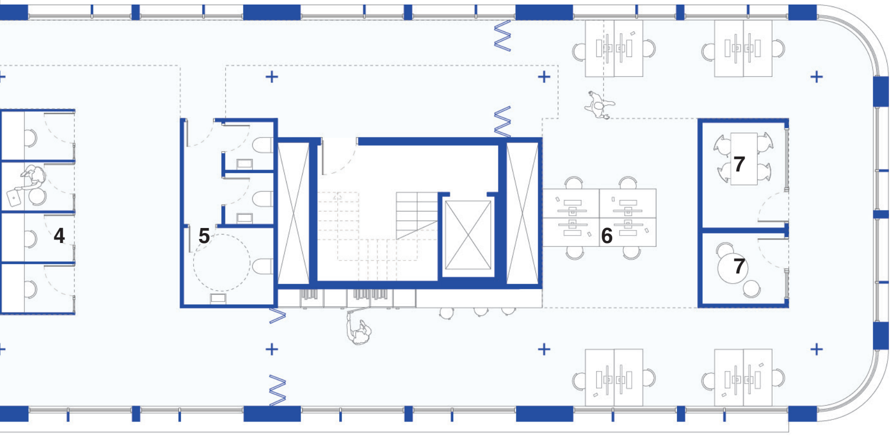
172. Neighbourhood Hub level 01, scale 1:200

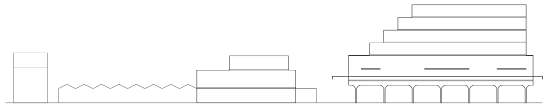


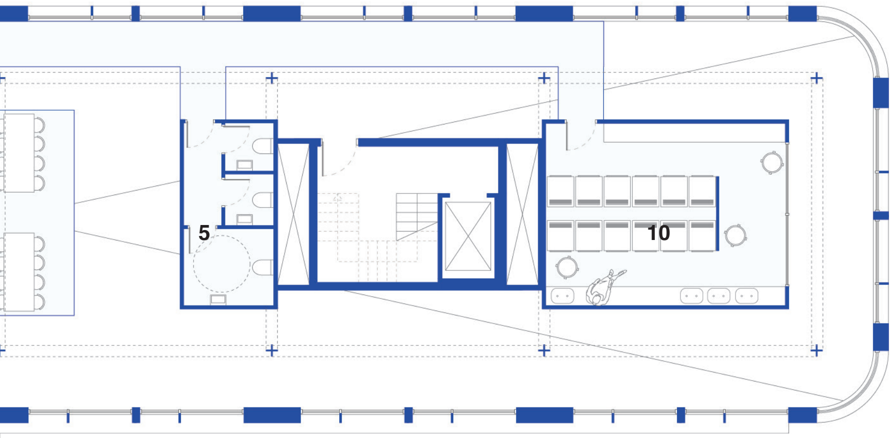
173. Neighbourhood Hub level 02, scale 1:200

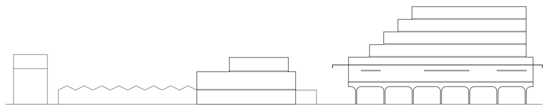
Level 01 and 02 represent the body of the Neighbourhood Hub with vital functions embracing the modes of occupation and inhabitation of the new house by the community and residents. The overall quality is enhanced by a layout independent of the load-bearing structure making the two floors highly flexible to suit future needs.

1. Library niche
2. Workstations
3. Common workspace
4. Teleworking
5. Toilets
6. Commercial office
7. Meeting room
8. Niche
9. Common house
10. Laundry room



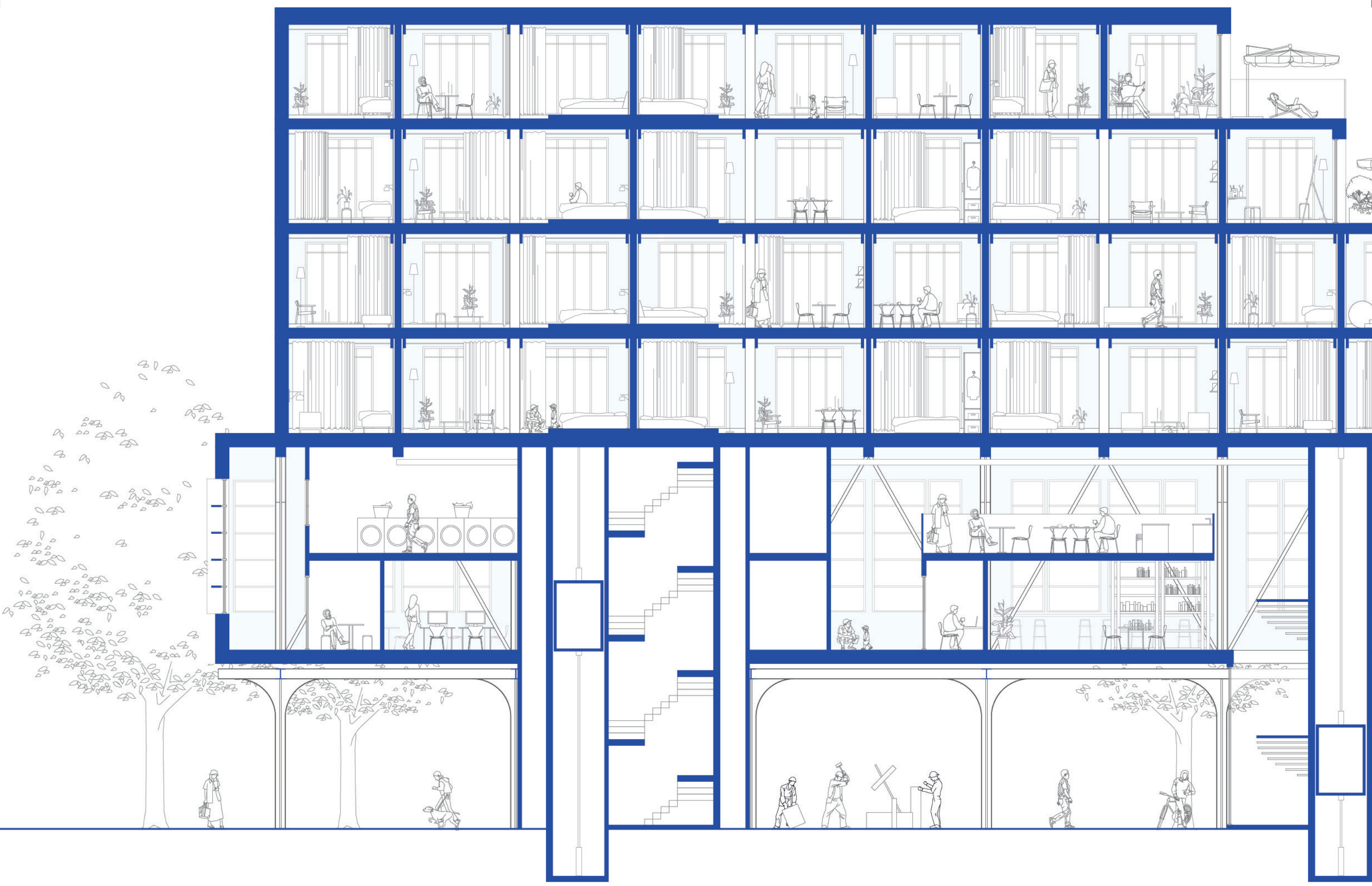




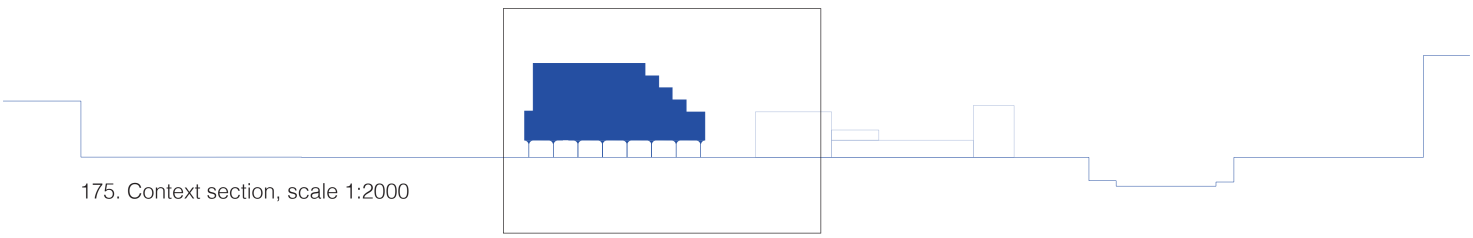


Level 01 is designed to accommodate a diverse branch of working opportunities. Inspired by the principle of co-working, the floor invites for teleworking, individual work, meetings and larger gatherings as well as a corner suitable for a commercial office.

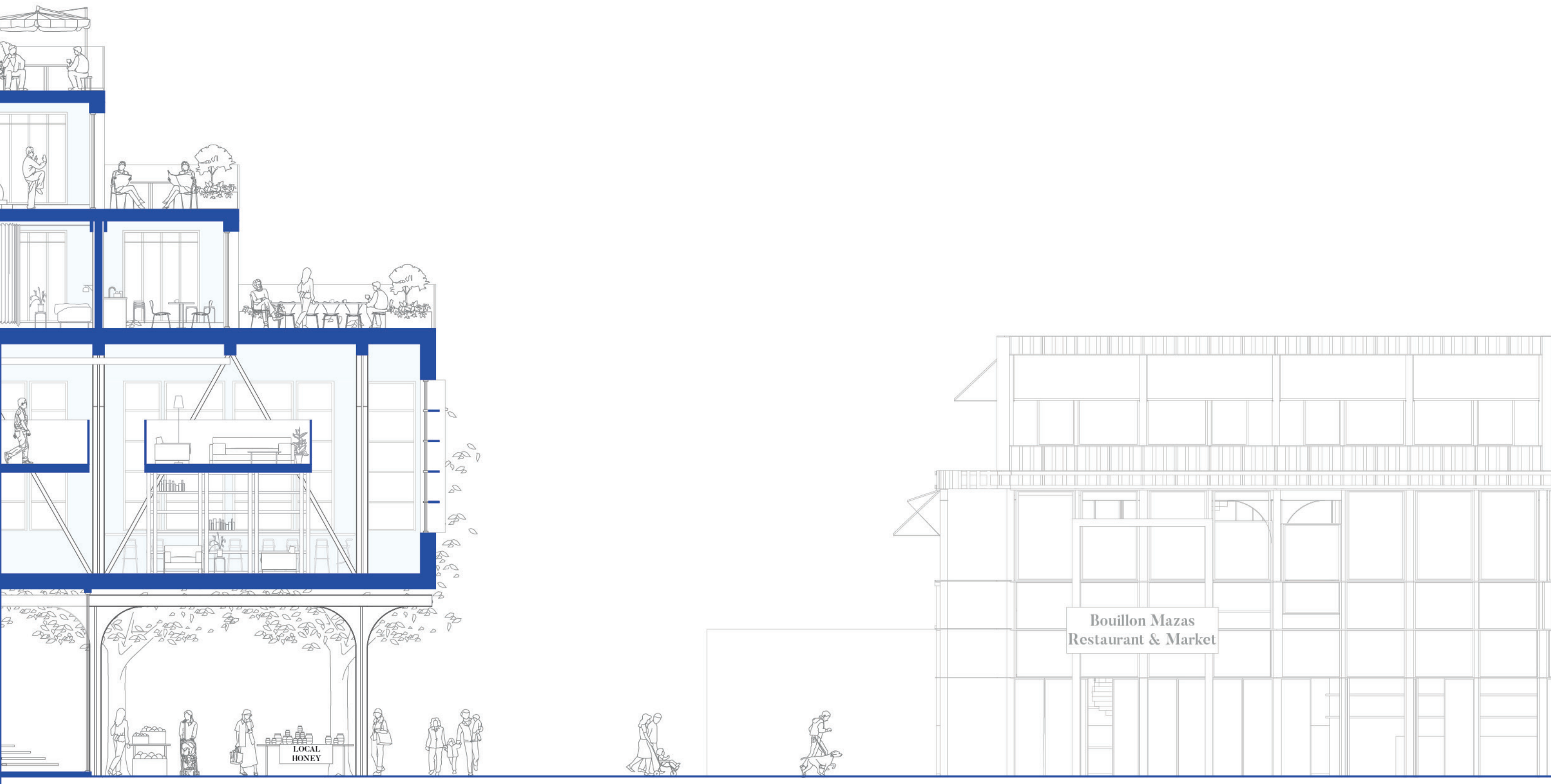
Level 02 becomes the Common House of both residents and the nearby community. The functions position themselves as small islands and intensify the possibility to encounter an atmosphere of openness and community.

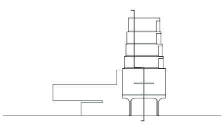


174. Neighbourhood Hub section BB, scale 1:200



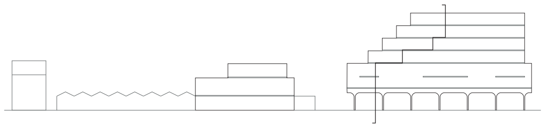
175. Context section, scale 1:2000


LOCAL HONEY
Bouillon Mazas
Restaurant & Market

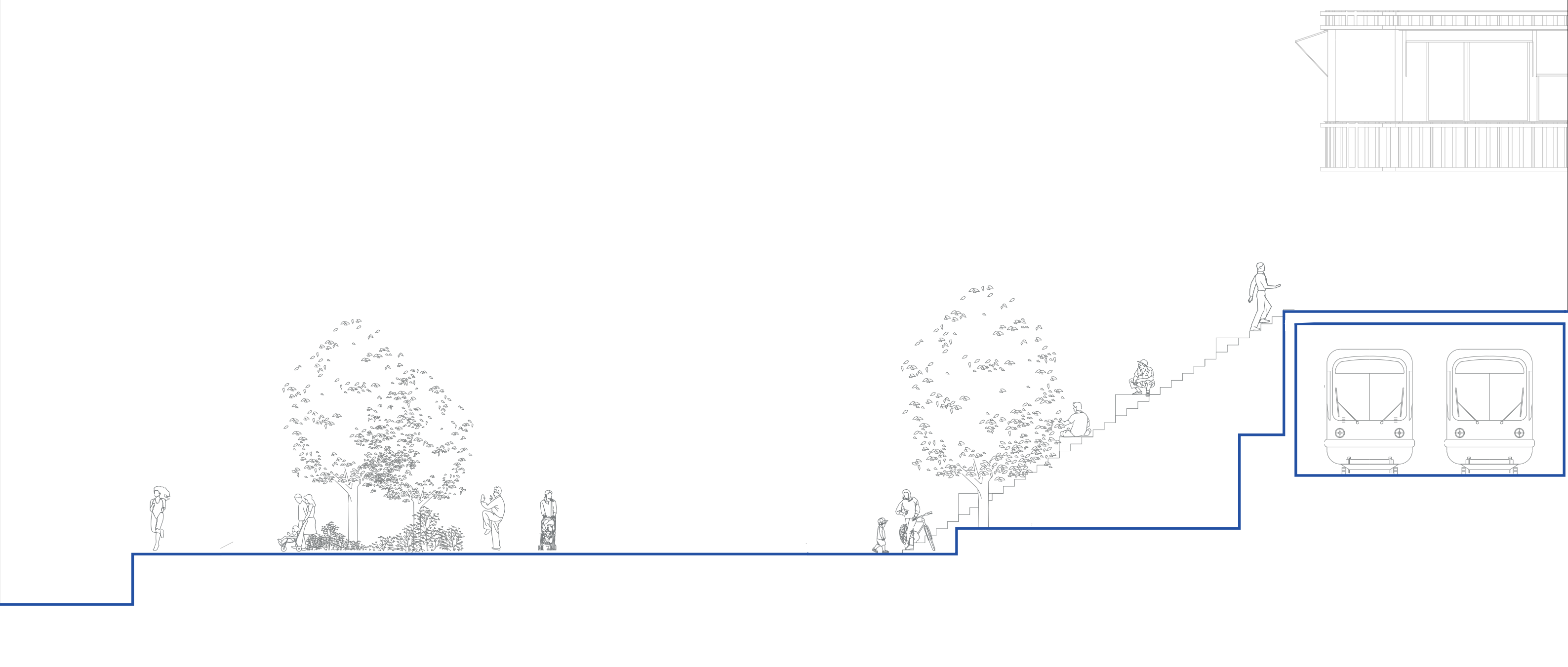


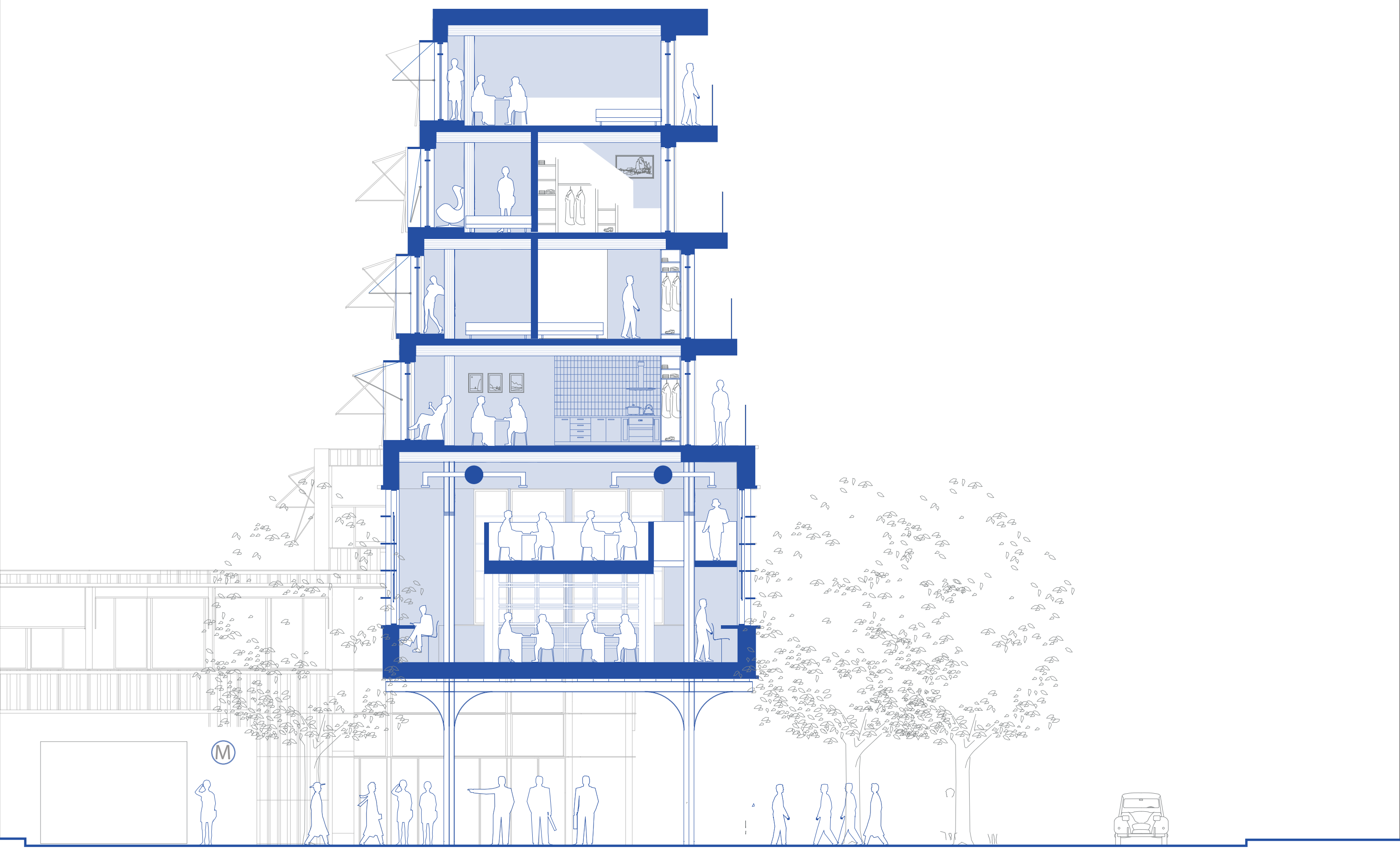
A common space for residents and the neighbourhood to gather. A space filled with light flowing through the treetops surrounding the entire building and creating a warm and calm atmosphere. One inclusive space is defined and carried by the large steel columns that elegantly exhibit the double-height flexible room through the long uninterrupted views. With the steel columns gracefully merging into the wooden construction at the ceiling, the tektonics tell a story of what lies above; a story of the transition from public to private spaces.

176. Visualisation of the common space of the Neighborhood Hub

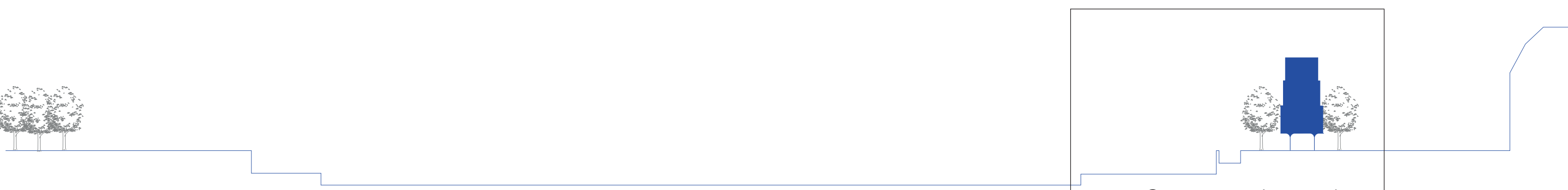


The Neighbourhood Hub positions itself as a new step in the urban fabric enhancing an already existing inherent scale reduction towards the water. Introduced by a gentle variety in the section, spacious diversity and new urban connections. A greater urban ecosystem between public and private explorations is revealed.

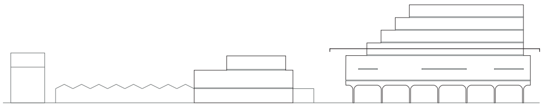


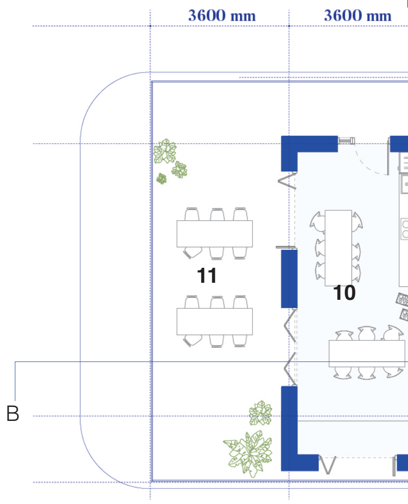


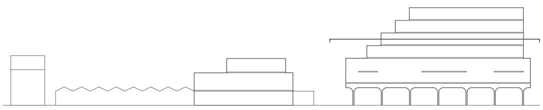
177. Neighbourhood Hub section CC, scale 1:200

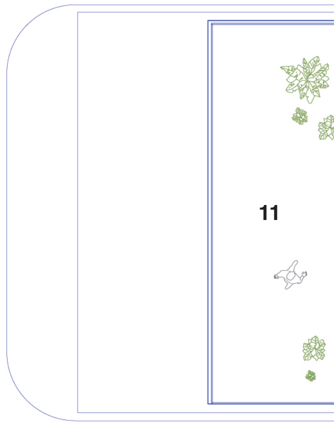


178. Context section, scale 1:2000

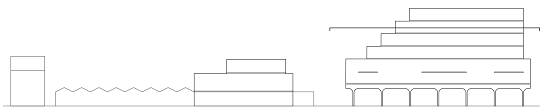


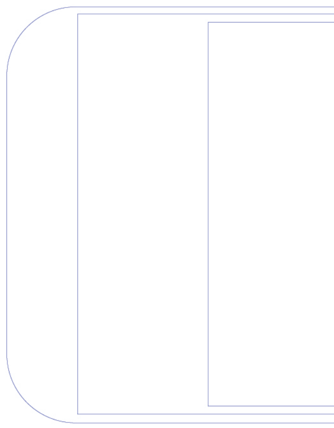




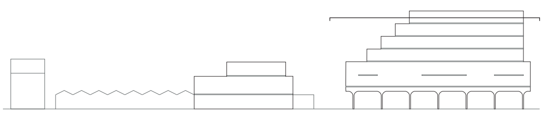


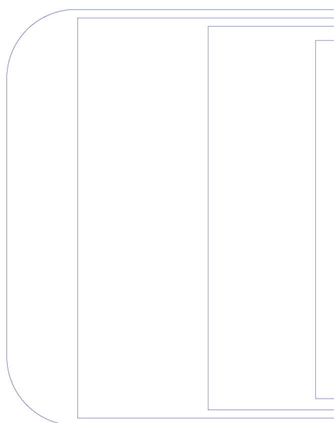
1. Apartment, 31 m²- 38 m²
2. Apartment, 47 m²- 54 m²
3. Apartment, 62 m²- 73 m²
4. Apartment, 46 m²- 56 m²
5. Chamber, 17 m²- 20 m²
6. Apartment, 48 m²- 56 m²
7. Common space
8. Common workspace
9. Common training space
10. Common dining
11. Terrasse

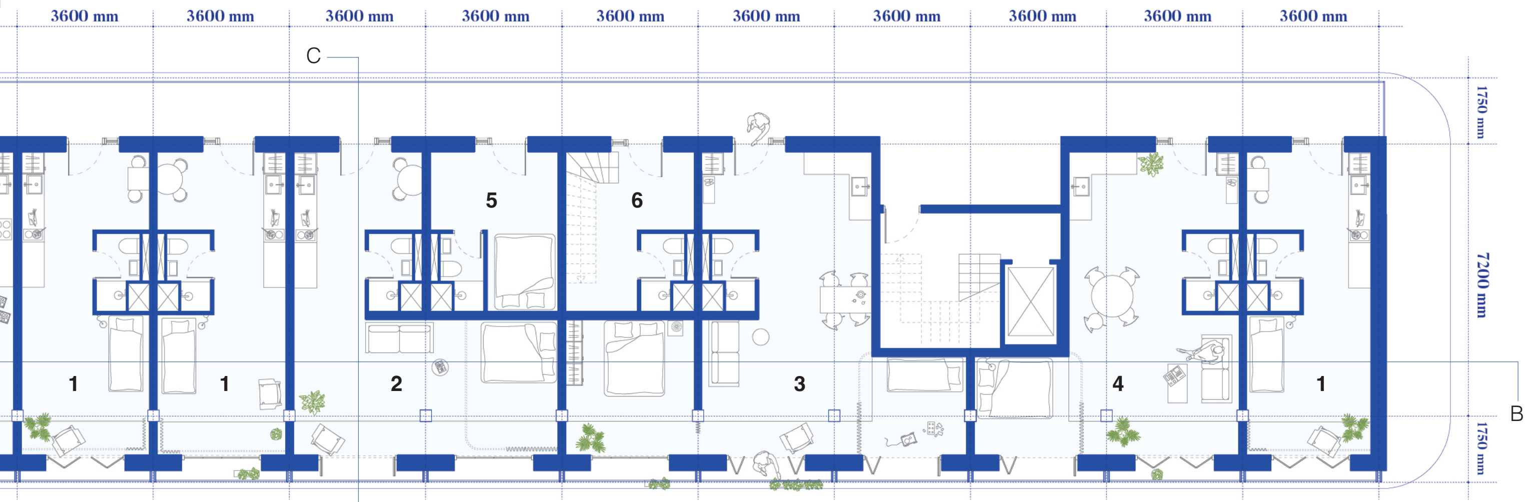




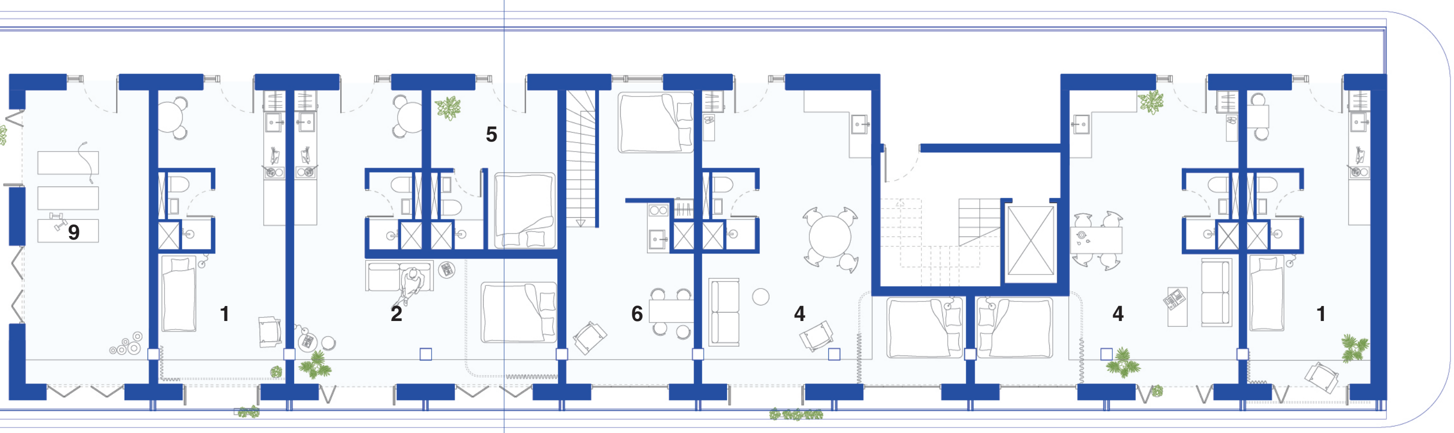
The Neighbourhood Hub offers a wide range of habitation from small chambers to spacious 3-roomed flats changing from floor to floor as the section of the house evolves. The difference and variety promote diversity among users based on a closely reasoned concept, where each dwelling is the consequence, vertically as well as horizontally, of the other. This calls for functional simplicity manifested in the use of a stand grid span and combined cores utilising the divisions in the construction. Each floor has a special shared function in a unique connection to a roof garden with a splendid view towards Place Mazas square, the river Seine and Bassin de l'Arsenal.



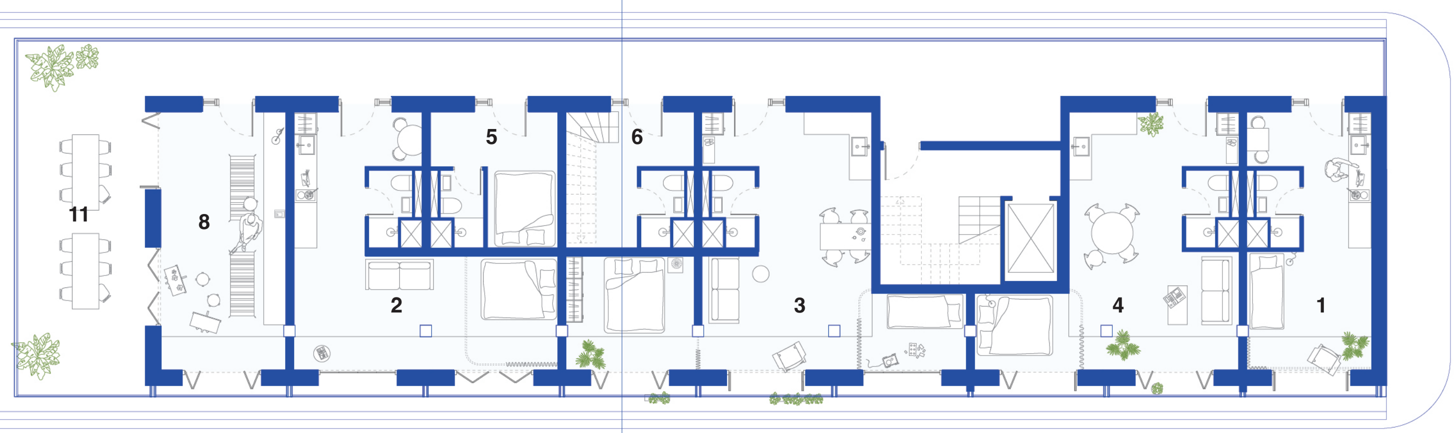




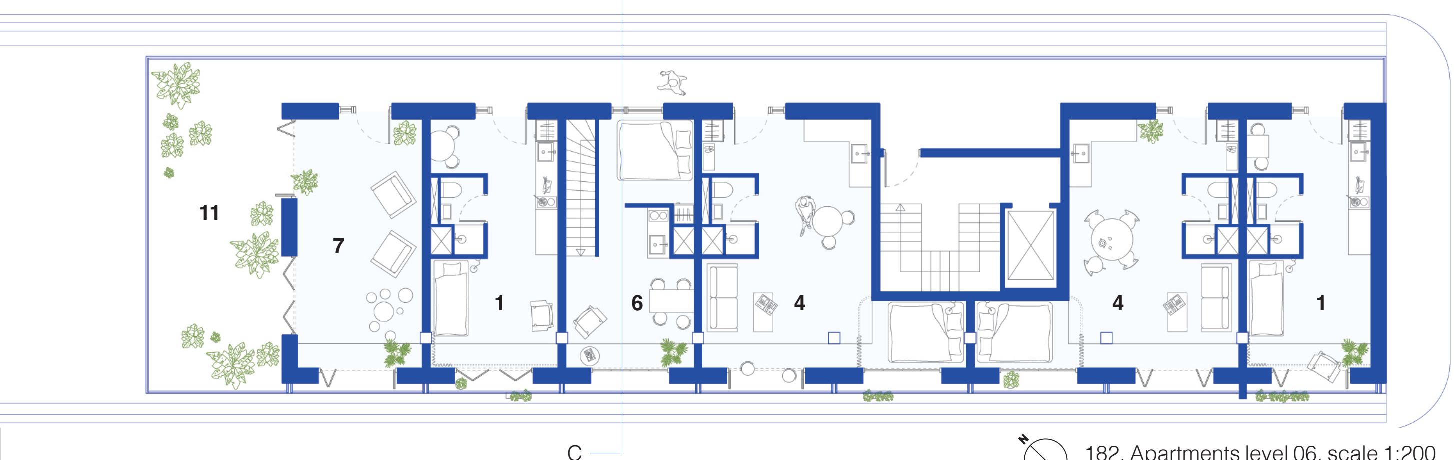
179. Apartments level 03, scale 1:200



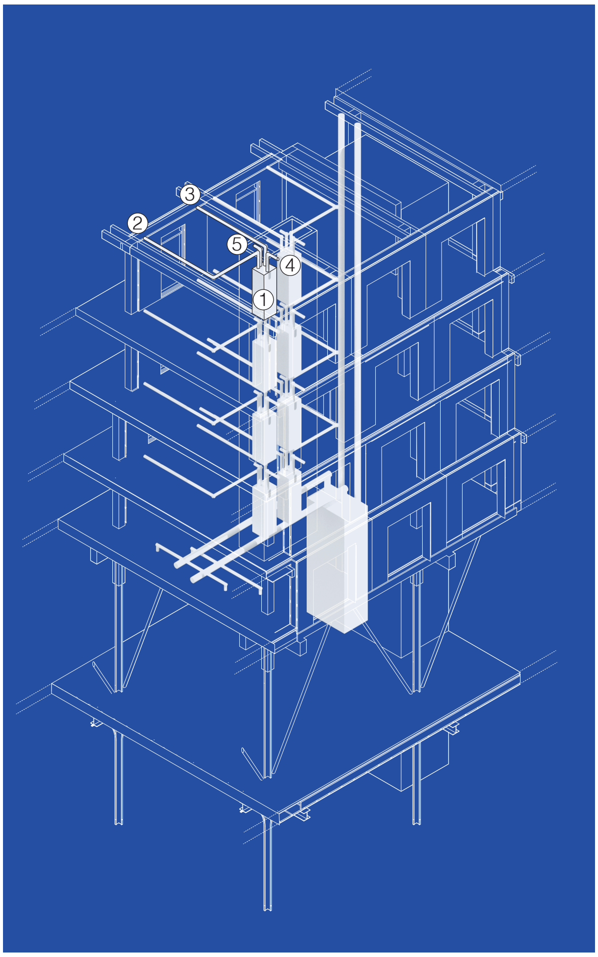
180. Apartments level 04, scale 1:200



181. Apartments level 05, scale 1:200



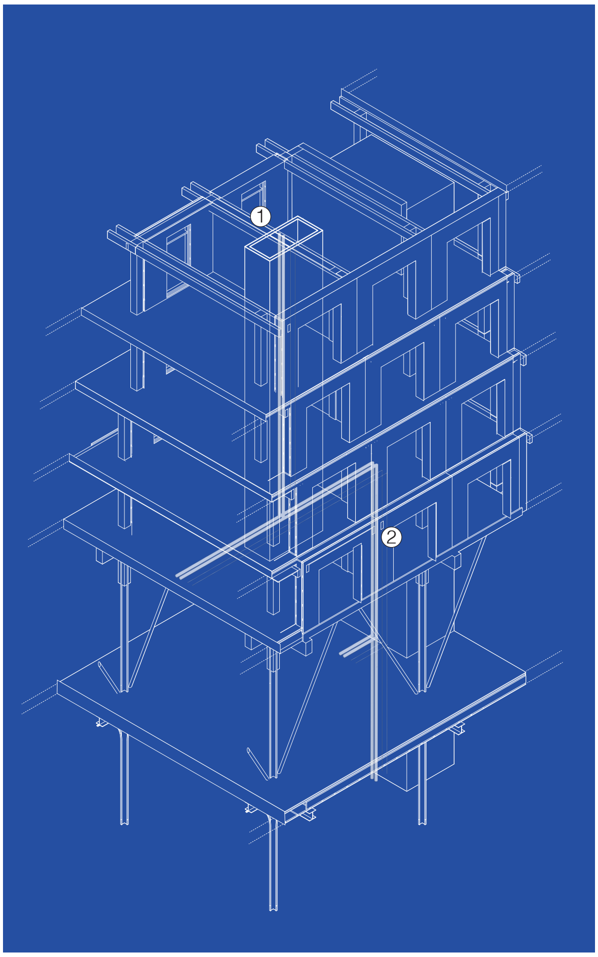
182. Apartments level 06, scale 1:200



183. Mechanical ventilation

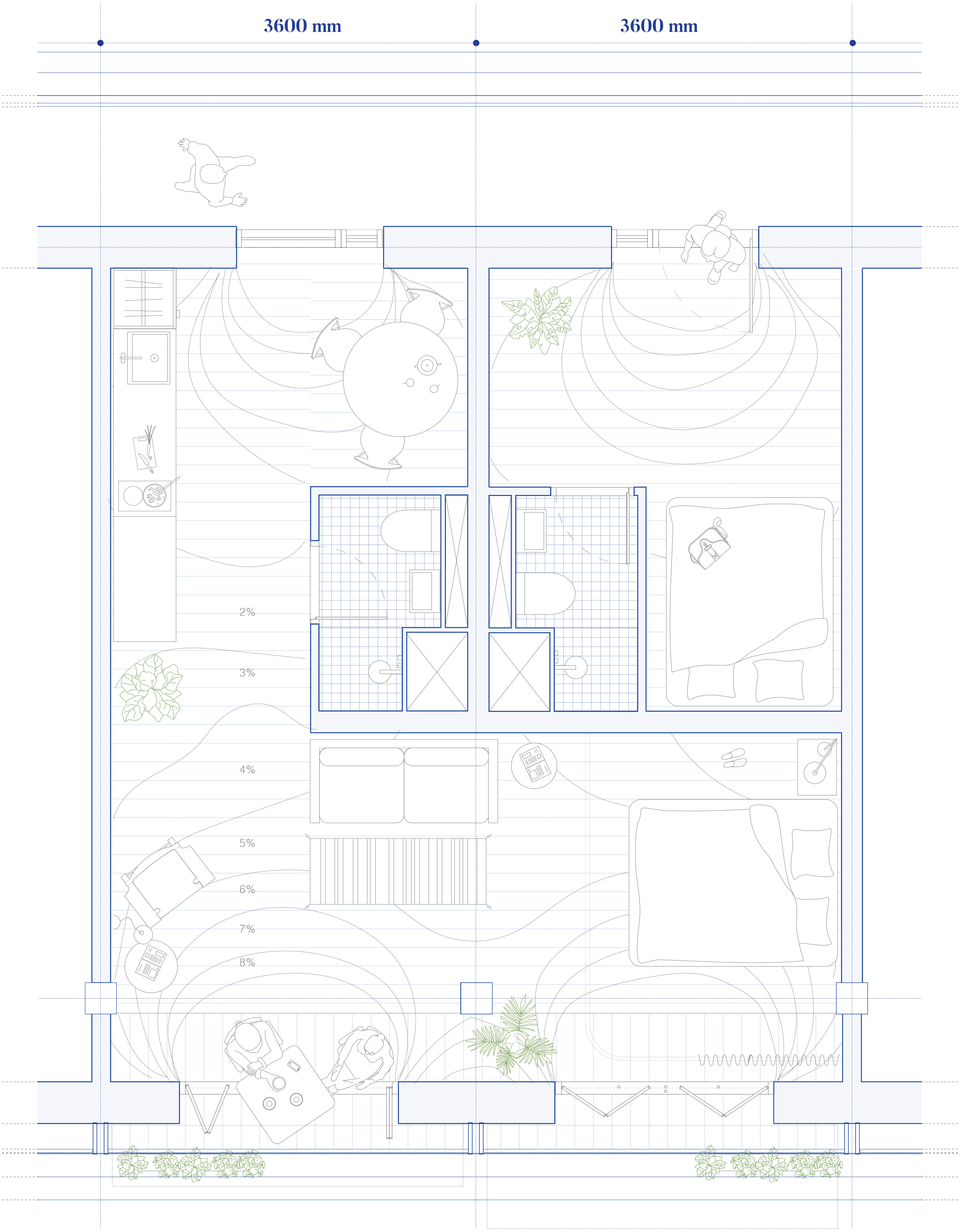
Each apartment is supplied with decentral-ventilation, variable air volume (VAV) mixing systems [1]. The intake [2] and return [3] piping are placed at a minimal distance of 3 metres through the northern facade. The kitchen/dining area is supplied with a fresh air supply [5] and the toilets har supplied with an extraction system [5].

The shared space is supplied with central ventilation, variable air volume (VAV) mixing system. The intake and return piping are led through the concrete core and up through the rooftop with a minimum 1-metre vertical distance.

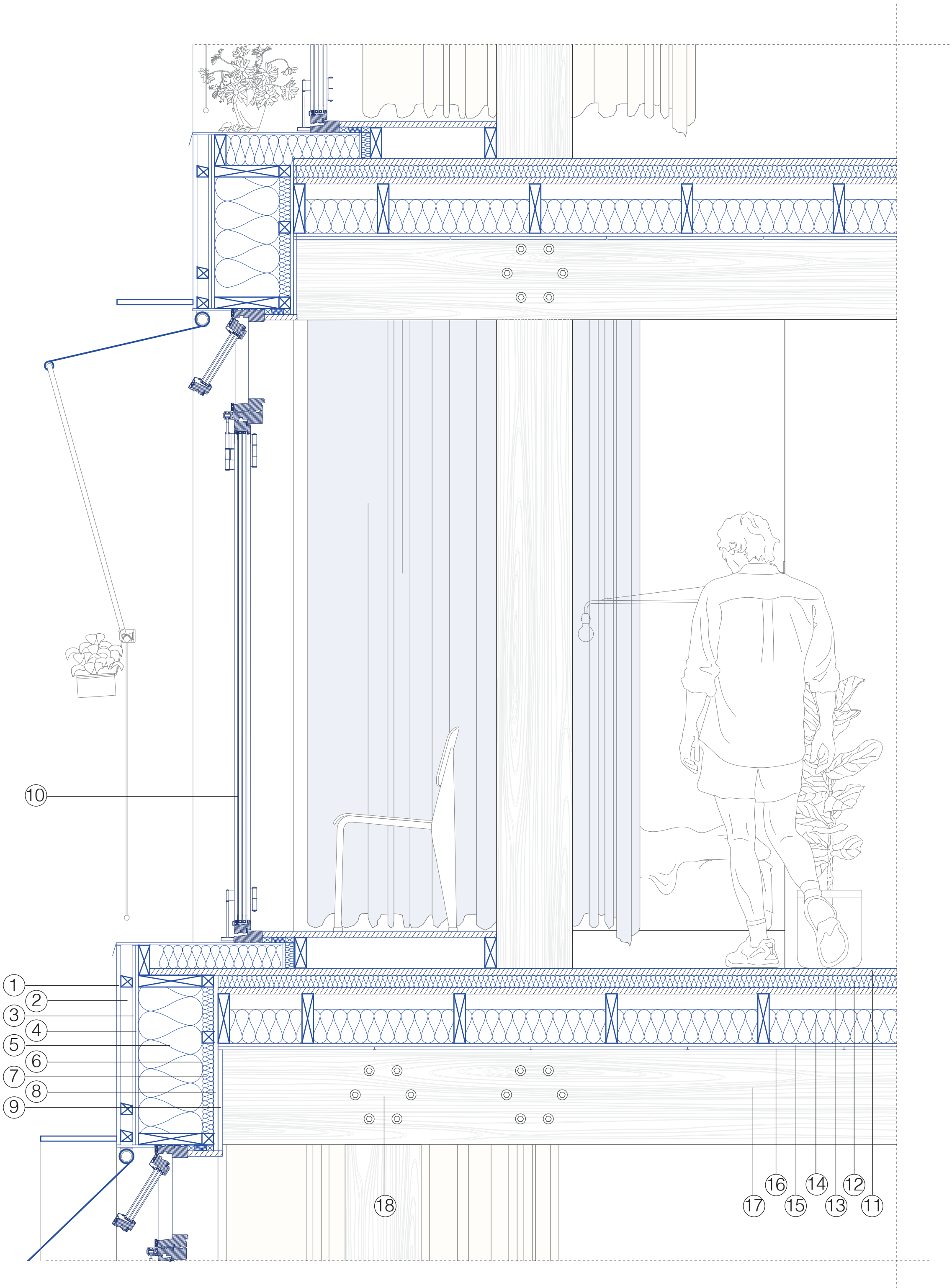


184. Public utility

The building is designed for flexible piping of public utility installations. The pipe can be led through technical cores and wooden horizontal and vertical divisions. The technical cores are placed strategically in pairs [1] between two apartments to minimise the loss of livable space. The horizontal and vertical divisions are constructed in lightweight timber and facilitate the integration of the public utility piping into the divisions. The main supply is led through the concrete core (fire escape core) [2] and up to the different technical cores in each apartment and the shared space.



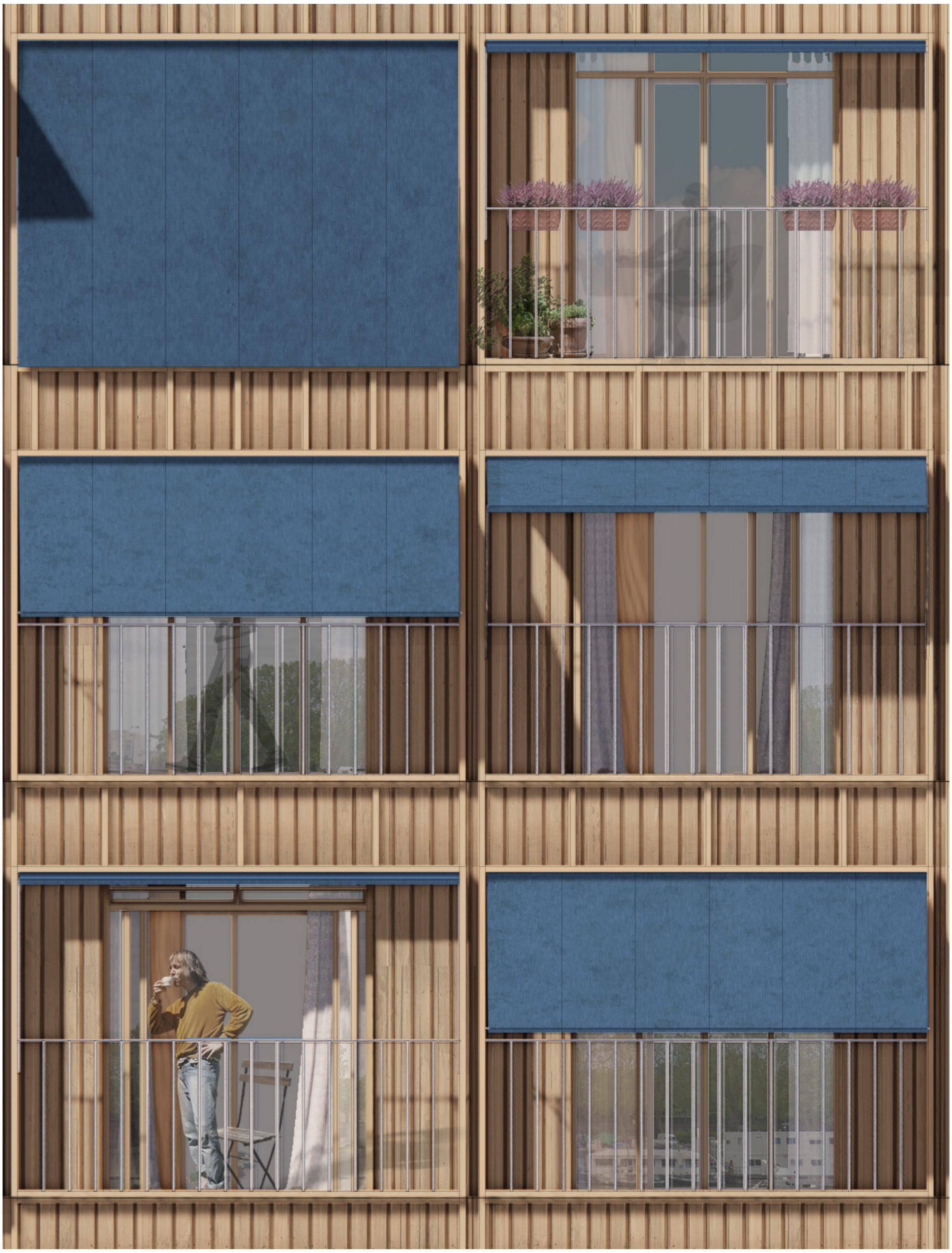
Plan zoom with Daylight Factor, scale 1:50



185. Building detail, facade - shading, scale 1:25

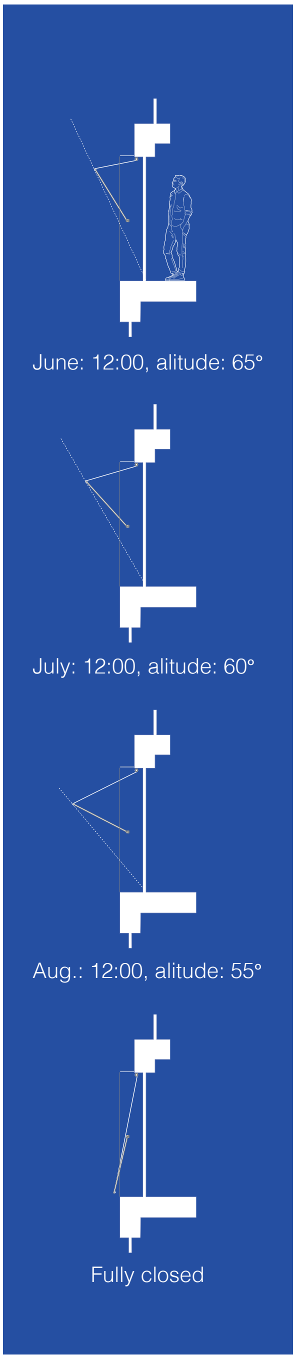
Building envelope
1. Vertical facade wood cladding, 22 mm
2. Wood lath, 45 x 45 mm per 600 mm
3. Wood furring strips, 12 x 50 mm per 600
4. Plywood - 12 mm
5. 250 mm wood fibre insulation, 50 x 250 mm wood joists per 600 mm
6. Vapour barrier
7. 45 mm wood fibre insulation, 45 x 45 wood laths
8. Gypsum, 12.5 mm
9. Internal wood cladding, 22 mm
10. Three-layer folding door

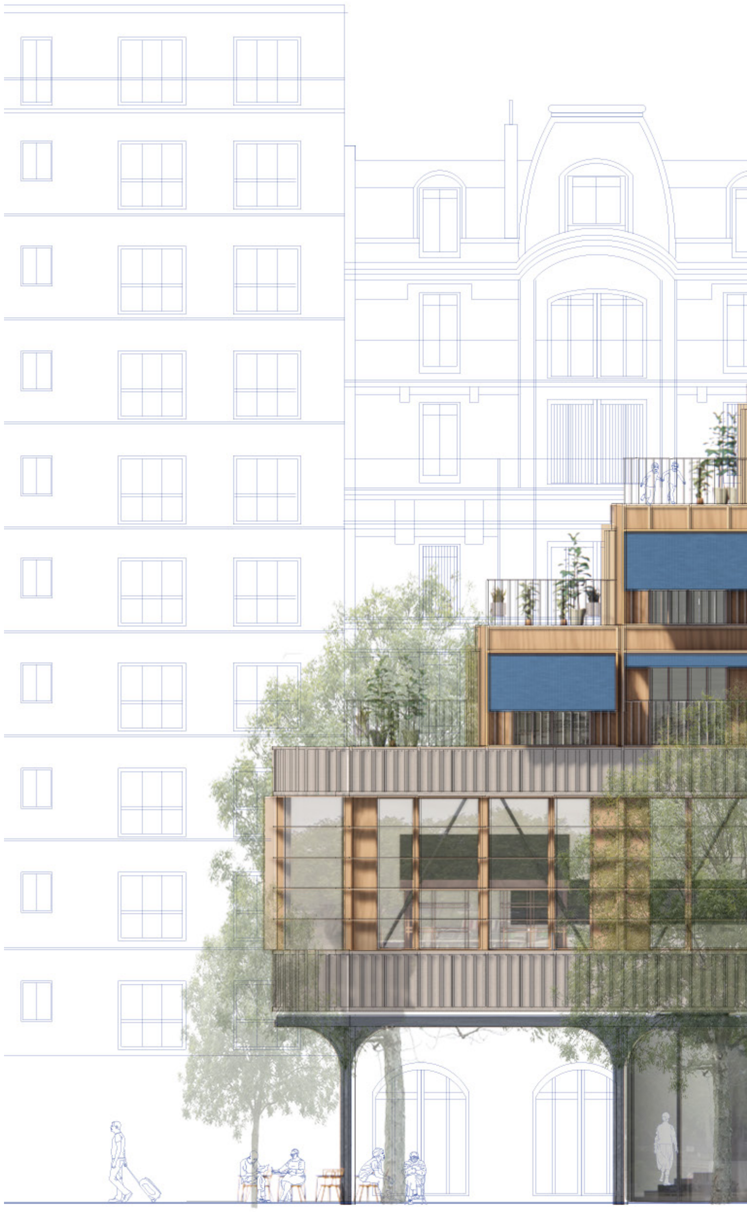
Horizontal division
11. Wood Flooring
12. 50 mm acoustic flooring underlay
13. Plywood, 19 mm
14. 130 mm fire-safe insulation, 45 x 200 wood joists per 600 mm
15. Wood lath, 12 x 150 mm
16. Wood ceiling cladding
17. Load bearing Glulam beam, 185 x 500 mm per 3200 mm
18. Rigid joint w/ dorns

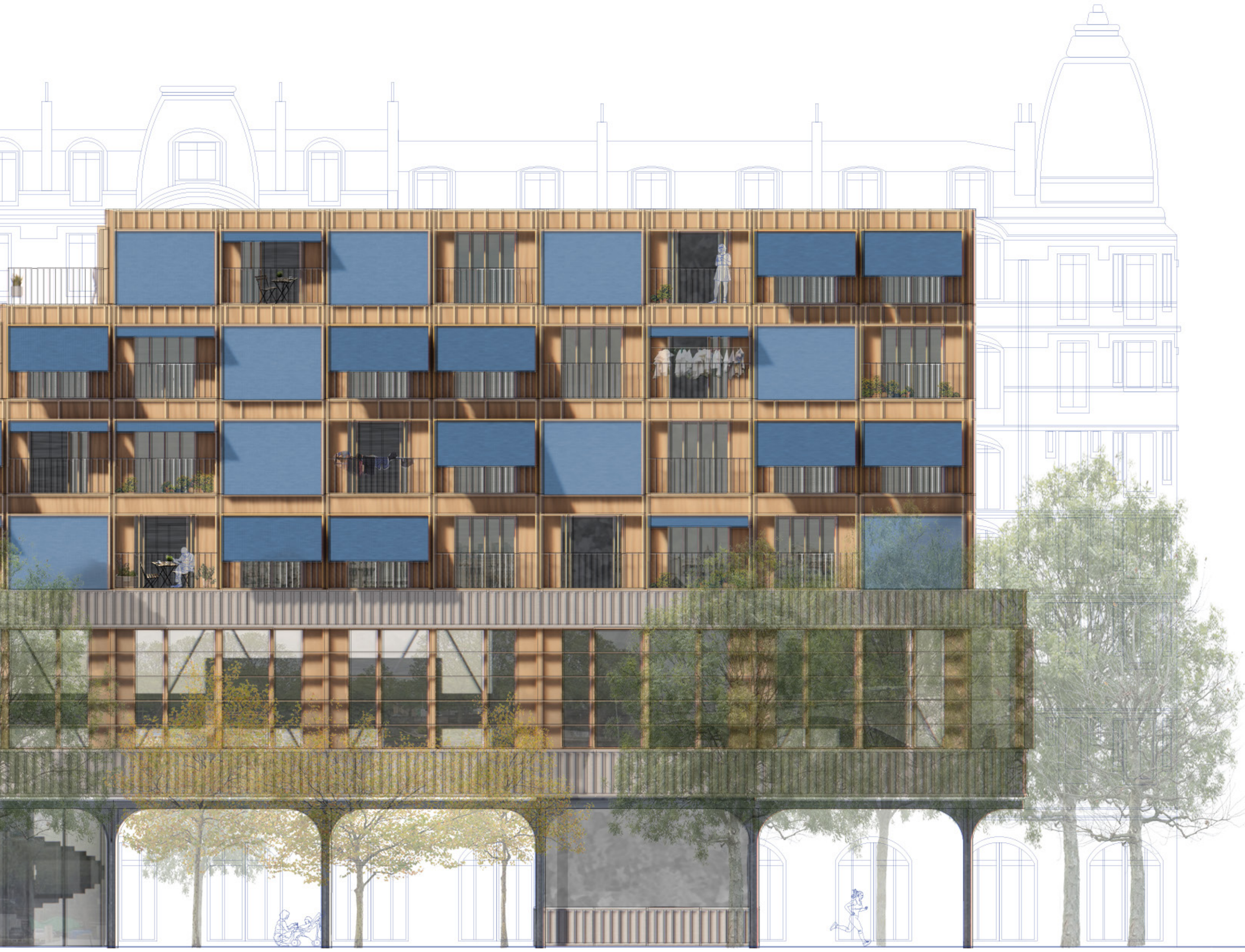


186. Facade sample 1:50

Solar Shading, manually controlled by the user, creates behavioural opportunities. With the design of the shading, it is possible to block the high summer sun while still looking outside. A step is created inside the apartment on level with the french balcony, which creates the possibility to extend the outside area into the apartment during summer.


June: 12:00, alitude: 65°
July: 12:00, alitude: 60°
Aug.: 12:00, alitude: 55°
Fully closed





The shading, controlled by the user, stands out in its blue colour as a gesture to its neighbour, the river Seine. The colour gives character to the building and has the ability to become a landmark in its near context. With the shading being controlled by its user it is in constant transition and becomes a conversation with the city and its viewer. The liveable facade oozes life and tells a story of the life lived beneath it.

187. Facade elevation south-west, scale 1:200

Conclusion

The Place Mazas square is transformed from being a square with no identity lying within a crossfield of heavy infrastructure and unobtained unique potential. The new *Neighbourhood Hub* and *Food Hub* come together in an ecosystem with a strongly sustainable focus and a wish to push the way in which we live, interact and take responsibility in modern society. The structures manifest themselves translated expression and tectonic approach to architecture in Paris. This is obtained by a strong solidarity to the existing with a desire to learn from the present and to build for the future. The *New Place Mazas* attempt to offer attractive and socially sustainable opportunities for new modes of *living, being* and *inhabiting* the city. It attempts to create a greater coherence between functions and the city itself, creating new urban links, new sustainable job specifications, new focus and awareness on sustainable food production, to create a resilient site with the ability to adapt to the future. The theoretical and analytical explorations highlight that new developments in a dense city such as Paris can not function on its own. It is believed that designed and programmed as ecosystems, a site and its functions has the ability to obtain its full potential and create a whole that becomes greater than its parts. With this understanding the *New Place Mazas has* a *ecological tectonic approach* to both its building structures, its urban layers and the general programming.

Working with the rich history and traditions of Parisian architecture has poised and challenged the architectural intentions. Creating architecture within a city such as Paris has demanded a well-established understanding of the contextual surroundings, urban as well as the architectural context, ingrained in both theoretical and, most importantly, first-hand experiences. Implementing the obtained knowledge of a characteristic architectural expression has shown to be important as well as looking back and being inspired in the use of steel, while looking forward and taking a necessary approach to the use of wood in modern building structures.

The functions programmed to the site are based on theoretical and societal investigations of the needs of Paris, both now and in the future to ensure actuality in the design development. With a strong devotion towards connected and shared mixed use cities the site is developed with a deliberate attempt to create beneficial social conditions. This by mixing primary functions such as habitation, workplaces and restoration, ensuring use throughout the day, and a mix of user groups all creating a safe and diverse atmosphere. The mixed functions used by both inhabitants, neighbours, visitors and by-passers will create a livable *New Place Mazas* allowing for the city and its people to live, breathe and develop.

The project attempts to be both sympathetic and dearing to its surroundings through its architectural approach. The unique site offers an inherent potential to connect to the river Seine, which the *New Place Mazas* invents through urban developments and architectural intentions. ***Exploiting the existing structures through re-programming, transformations and extensions allows for new pages in the story of the exceptional site of the New Place Mazas to be written and evolve as time goes on.*** With the global climate crisis we must remember to appreciate and embrace the already existing, referring to not only the built environment, but also the everyday life and the planted environment. The existing trees have been preserved and integrated in the creation of the Place Mazas as a great asset and quality to the architecture, as well as the fluent dynamics of people in motion has been of paramount interest.

This project serves as an urban and architectural strategy of exploiting undeveloped unique sites in dense cities such as Paris. With a strong architectural coherence to the architectural and urban context the project is developed to reclaime and activate a constrained urban island. It presents a site consisting of multiple differing building volumes and functions that create a new socio-cultural typology of a mixed-use site. A site where inhabitants, neighbours, visitors and by-passers can thrive together.

At the New Place Mazas Square social and cultural functions intermingle with the contextual energies and generate synergies extending into the streets of Paris.

Reflection

The design proposal for a *New Place Mazas square* is an independent project not following constraints and guidance of an existing design-brief of the site. Consequently, this entails a unique opportunity to conduct thorough studies of Paris' visionary development-plans in the transition towards a sustainable city of the future. Thus it forced the project to *wonder, ask questions* and *critically assess* political declarations of intent to be able to define a well argued problem scope of the project as a necessity to be able to concretize the ambitious political strategies. What has been presented in these declarations is without actual solutions, resulting in the project's attempt to manifest how an architectural-tectonic thesis project could in fact become the answer to the political declarations of intent. In these circumstances working on a larger scale, focusing on *programming, building volumes* and *urban strategies*, the project has been created. Only through merging the smaller and larger scale it is believed that great architecture can be created, however it has been a challenge to move from the early-phase large urban and political scale to the smaller detailed architectural scale. All this resulted in a comprehensive time consuming puzzle to construct the framework of the project, but additionally fostered great motivation, acting as a catalyst through the design process.

The urban theoretical studies indicate that the programming and understanding of Place Mazas and its inherent qualities and challenges has crucial importance to be able to develop the site and its functions properly. The project positions itself as strongly coherent to the surrounding city and the life lived within it. This project and processes, with the focus on understanding and building in the city, more than another, has emphasised the importance of a first-hand site visit. The understanding of the site and the indescribable ideas that arose during the first encounter became indispensable for the concept and further development of the project. Although these sketches and the reading of the site has been essential to the development of the concept it has been a challenge to conduct convincing evaluations of the sketching material created most of all by creative intuitions. Nevertheless the journey the first-hand sketching invited to has been of great influence through the project. Summarised, the inspiration the first-hand site visit has resulted in only exists because of cogent decision to conduct hand sketching and other experimental analyses.

The project has positioned itself and its awareness towards creating architecture in relation to the existing city and its contextual conditions. In general it is our belief that architecture is created in the light of its users and functions. These aspects could be argued to foster two different architectural approaches because of the difference in scale. With great awareness this thesis, quite simplified, asks the site, the ***people in motion***, the ***trees*** and the ***surrounding city*** what the inherent hidden potentials are for future developments. Hence, the user group is analysed by observations of *everyday flow*, *segmentation of the* *passers-by* and *litteratur studies* of what the city of Paris itself states on behalf of its citizens. Resulting in a thought of the city as the user-group, as a city-system only exists by the presence of life on the streets. Another approach could have been to utilise design ethnographic methods like *personas* and *user-scenarios* defining a representative user-group, which despite the comprehensive work of the execution, could have been great support in relation to evaluation of crucial design steps.

Another perspective when creating architecture, with the crucial point centred around the building itself, might result in a project with a higher level of detail, spatial studies and encounters with different atmospheres. Architectural qualities which appear attractive to have had the possibility to explore to a greater extent in the thesis project. Additionally, the architectural challenge to merge ecological thinking in larger urban scales presented in the thesis with the intangible exploration in the creation of specific intended atmospheres and experiences seem utmost interesting and challenging.

Creating this thesis has been done with a tectonic approach in its widest sense. Tectonics of the urban strategies, tectonics of functions, and tectonics of architectural building details, a whole that becomes greater than its parts. With the complexity of vertical and horizontal layering in the city of Paris, the constructing and construing becomes manifold. Furthermore the complexity of creating great, ecological, tectonic architecture is a comprehensive matter. We are finding ourselves in a time of a global crisis, which has led to complex and discussionable regulations set by political agendas. Regulations based on science and engineering, where decisions are made upon quantitative measurements rather than upon architectural quality and human wellbeing. With the building industry being one of the biggest climate sinners in the global crisis, it is a necessity and a great quality that political action is taken. However with this project it is discussed whether the regulations and the tendencies in the building industry at the moment does in fact create great sustainable architecture, or if what is created is in fact 'fast-architecture' fulfilling regulations but lacking architectural intention. In this thesis project it has become clear how complex it is trying to merge architectural and tectonic qualities with energy regulations and demands. *It is a topic of great interest and a topic with the potential to be further displayed, while it is of huge necessity for the architectural quality, human- and planetary wellbeing.*

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Appendix

Appendi A: Calculating dimensions in Robot

Load Combination

ULS	$\sum_{j\geq l} \gamma_{G,j} G_{k,j} + \gamma_{Q,1} Q_{k,1} + \sum_{j\geq l} \gamma_{Q,i} \psi_{0,i} Q_{k,i}$
SLS	$\sum_{j\geq l} G_{k,j} + Q_{k,1} + \sum_{j\geq l} \psi_{0,i} Q_{k,i}$

γ_G is the partial factor for permanent loading
G_k is the permanent action
$\gamma_{Q,}$ is the partial factor for variable loading
ψ_0 is the factor that converts its variable action into its combination value
$Q_{k,1}$ is leading variable action
$Q_{k,i}$ is an accompanying variable action

Critical load case
The following critical load case is using liveload as the dominating variable load and has snow load and wind load as the accompanying variable loads.

The dead load is calculated by the FEM-design software Robot.

Attention
The example in this appendix is not the final calculations conducted in the project. The method is identical to how the final section is found [p.xx]. This is done with an agreement from the technical supervisor.

Partial coefficient (γ)

DS/EN 1993 FU:2009 - Forkortet udgave af Eurocode 0 - Projekteringsgrundlag for bærende konstruktioner (2009), p.44

Load Combination			1	2
Ref. form.			(6.10a)	(6.10a)
Permanent load	Permanent action	Unfavourable	$1,2\ x\ K_{FI}$	$1,0\ x\ K_{FI}$
Variable load	Leading	Unfavourable	0	$1,5\ x\ K_{FI}$
	Accompanying	Unfavourable	0	$1,\ x\ \psi_0\ x\ K_{FI}$

Consequence classes

The consequence classes (CC) consider the consequence of failure or malfunction of the structure

DS/EN 1993 FU:2009 - Forkortet udgave af Eurocode 0 - Projekteringsgrundlag for bærende konstruktioner (2009), p.18-19)

Consequence classes	K_{FI} factor for actions	Description	Example of buildings and civil engineering works
CC1	1,1	High consequence for loss of human life, or economic, social or environmental consequences very great	Grandstands, public buildings where consequences of failure are high (e.g. a concert hall)
CC2	**1,0**	**Medium consequence for loss of human life, or economic, social or environmental consequences considerable**	**Residential and office buildings, public buildings where consequences of failure are medium (e.g. an office building)**
CC3	0,9	Low consequence for loss of human life, or economic, social or environmental consequences small or negligible	Agricultural buildings where people do not normally enter (e.g. storage buildings), Greenhouse

Combination factors ψ

Tabel A1.1 DK NA ψ faktorer for bygninger (Jensen, B.C 2015, p. 34)

Loads	ψ_0
Nyttelast i bygninger (DS/EN 1991-1-1)	
Kategori A: arealer til boliger	**0,5**
Kategori B: Kontorarealer	0,6
Kategori C: Større forsamlinger	0,6
Kategori D: Butiksarealer	0,6
Kategori E: Erhverv og lagerarealer	0,8
Kategori F: Trafikarealer Bruttovægt ≤ 30 kN	0,6
Kategori G: Trafikarealer 30 kN < bruttovægt ≤ 160 kN	0,6
Kategori H: Tage	0
Snow load	
In combination with leading imposed load category E or with leading temperature load	0,6
In combination with leading wind load	0
Other	**0,3**
Wind load	
In combination with leadning imposed load category E	0,6
Other	**0,3**

Characteristic variable loadings (q_K)

(Jensen, B.C 2015, p. 51)

Category	Anvendelse	Example	q_K [kN/m^2]	Q [kN]
A	Boliger mm.	**Rum i beboelsesbygninger** og huse, værelser og vagtstuer i hospitaler; soveværelser i hoteller; Køkkener og toiletter;	**1,5**	2,0
		tagrum og skunkrum	0,5	0,5
		Loftsrum	1,0	0,5
		Trapper	3,0	2,0
		Balkoner	2,5	2,0
B	Kontorer mm.	Kontor og let erhverv	2,5	2,5
C	Samlingslokaler	C1: Samlingslokaler med bordopstilling	2,5	3,0
		C2: Samlingslokaler med faste pladser	4,0	3,0
		C3: Samlingslokaler uden forhindringer for folks bevægelighed	**5,0**	4,0
		C4: Samlingslokaler med mulighed for fysiske aktiviteter	5,0	4,0
		C5: Samlingslokaler, der kan udsættes for voldsom trængsel	5,0	4,0
D	Butikslokaler	D1: mindre butikker	4,0	4,0
		D2: Større butikker og forretninger, stormagasiner	5,0	7,0
B-C1	Lokale adgangsveje		3,0	3,0
B-C1	Fælles adgangsvej	Fælles adgangsveje er eksemplevis trapperum og trappehuse i hele bygningens højde samt forhaller, der fører til disse. Øvrige adgangsveje betragtes som lokale	5,0	4,0

Snowload

The characteristic value for snowload s, is defined as followed:

$s = \mu_i \cdot C_e \cdot C_t \cdot s_k$ (Jensen, B. C 2015, p. 57)

μ_i is a formfactor for snowload depended on the shape of the roof (No unit)

C_e is an exposure factor

$C_e = C_{top} \cdot C_s$

C_{top} is a topographic factor

C_s is a sizefactor

C_t Is a termical factor. To be on the safe side the termical factor is set to 1,0

s_k characteristic terrain value

Formfactor

The formfactor is defined be using figur 3.6 in Last og sikkerhed (s.60)

$\mu_i := 0.8$ Slope of the the building roof is 0 - (Jensen, B. C 2015, figur 3.6, p. 60)

Exposure factor

$C_e = C_{top} \cdot C_s$ (Jensen, B. C 2015, p. 58)

$C_{top} := 1.0$ Normal topography - (Jensen, B. C 2015, p. 58)

C_s is set to 1,0 if $2\ h > l_1$ (Jensen, B. C 2015, p. 59)

$h := 27\ m$ $l_1 := 45$

$2 \cdot h = 54\ m$

$54 > 45$ The exposure factor is set to $C_s := 1.0$

$C_e := C_{top} \cdot C_s = 1$

Termical factor

To be on the safe side the termical factor is set to 1,0 (Jensen, B. C 2015, p. 57)

$$C_t := 1$$

Characteristic terrain value (Last og sikkerhed, s. 57)

$s_k := 1 \, \frac{kN}{m^2}$ (Jensen, B. C 2015, p. 57)

The characteristic value for snowload s is therefore:

$\boxed{s := \mu_i \cdot C_e \cdot C_t \cdot s_k = 0.8 \, \frac{kN}{m^2}}$ (Jensen, B. C 2015, p. 57)

Vindlast på bygninger

Karakteristisk vindlast

Geometri

Konstruktionens største sidelængde	b =	**45,0 m**
Konstruktionens mindste sidelængde	d =	**8,0 m**
Konstruktionens højde	z =	**27,0 m**

Basisvindhastighed

Basisvindhastighedens grundværdi	$v_{b,0}$ =	25,6 m/s
☑ Vælg afstand til Vesterhavet/Ringkøbing fjord	a =	**12,0 km**

Årstidsfaktor

☐ Tag hensyn til årstiden

Indflydelse fra høje eller nærtliggende nabobygninger

☐ Tag hensyn til store nærliggende konstruktioner iht. anneks A.4

☐ Tag hensyn til nærtliggende bygninger iht. anneks A.5

Orografifaktorer

☑ Tag hensyn til terrænets orografi for en eller flere vindretninger

Se fane 'Orografifaktor' for indtastning af parametre

Peakhastighedstryk, se fane 'hastighedstryk' for beregningsparametre

☑ Brug retningsfaktor fra SBi-anvisning 158

☐ Tag hensyn til bygningens orientering

☑ Tag hensyn til reduktion af peakhastighedstryk ved bund af bygning

Se fane 'Hastighedstryk' for optegning af peakhastighedstryk med højden

Vindretning		Værst	
Terrænkategori		**I**	
Peakhastighedstryk i top af bygningen	$q_p(z_e)$ =	1,61	[kN/m²]
Peakhastighedstryk i bund af bygningen	$q_p(z_b)$ =	1,25	[kN/m²]

Konstruktionsfaktor

☐ Tag hensyn til konstruktionsfaktoren

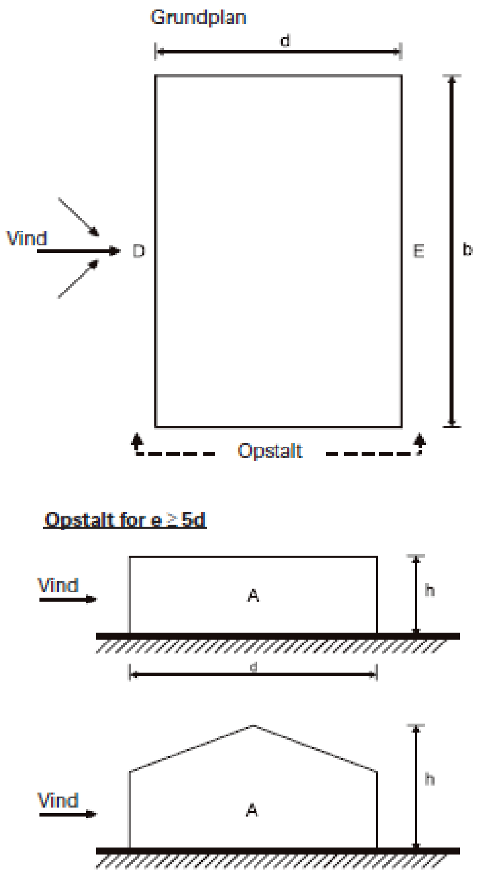
Konstruktionsfaktor facade	$c_s c_d$ =	1,00
Konstruktionsfaktor gavl	$c_s c_d$ =	1,00

Vindlast på bygninger

Formfaktor lodrette vægge

Vind på facaden

Vindretning	Værst	
Parameteren e	e =	45,0 m
Forhold h/d	h/d =	3,38



<u>Formfaktor for facaderne</u>

Zone D	$c_{pe,10}$ =	0,80
	$w_{k,D}$ =	1,29 kN/m²
Zone E	$c_{pe,10}$ =	-0,62
	$w_{k,E}$ =	-1,00 kN/m²
Korrelationsfaktor	ρ =	0,94
	$w_{k,DE}$ =	2,14 kN/m²

<u>Formfaktor for gavlene</u>

Zone A	$c_{pe,10}$ =	-1,2
Udstrækning	L_A =	8,0 m
	$w_{k,A}$ =	-1,93 kN/m²

Vindlast på bygninger

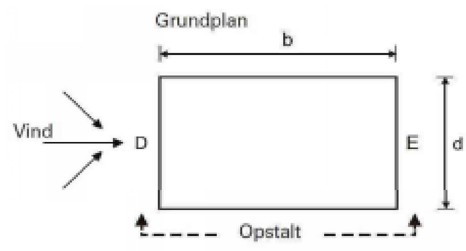
Formfaktor lodrette vægge

Vind på gavlen

Vindretning	Værst	
Parameteren e	$e =$	8,0 m
Forhold h/b	$h/b =$	0,60

Formfaktor for gavlene

Zone D	$c_{pe,10} =$	0,75
	$w_{k,D} =$	1,20 kN/m²
	$w_{k,D,bund} =$	0,93 kN/m²
Zone E	$c_{pe,10} =$	-0,39
	$w_{k,E} =$	-0,63 kN/m²

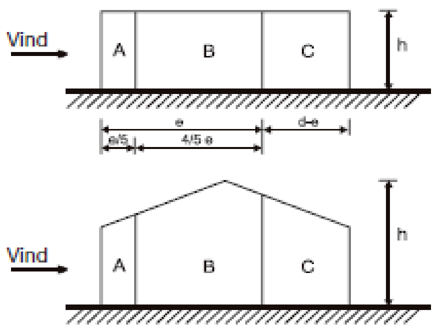


Korrelationsfaktor	$\rho =$	0,85
	$w_{k,DE} =$	1,56 kN/m²
	$w_{k,DE.bund}$	1,33 kN/m²

Formfaktor for facaderne

Zone A	$c_{pe,10} =$	-1,20
Udstrækning	$L_A =$	1,6 m
	$w_{k,A} =$	-1,93 kN/m²
Zone B		-0,80
Udstrækning		6,4 m
		-1,29 kN/m²
Zone C	$c_{pe,10} =$	-0,50
Udstrækning	$L_C =$	37,0 m
	$w_{k,C} =$	-0,80 kN/m²

Opstalt for e < d



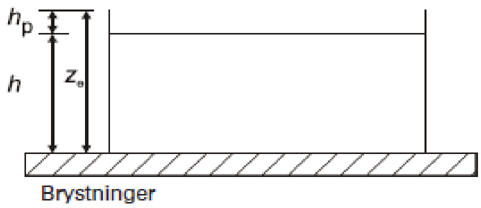
Vindlast på bygninger

Formfaktor tagkonstruktion

Valg af tagtype **Fladt tag**

Taghældning α = *NB: Gælder kun for hældning på -5 < α < 5*

Tagtype **Skarp tagkant**

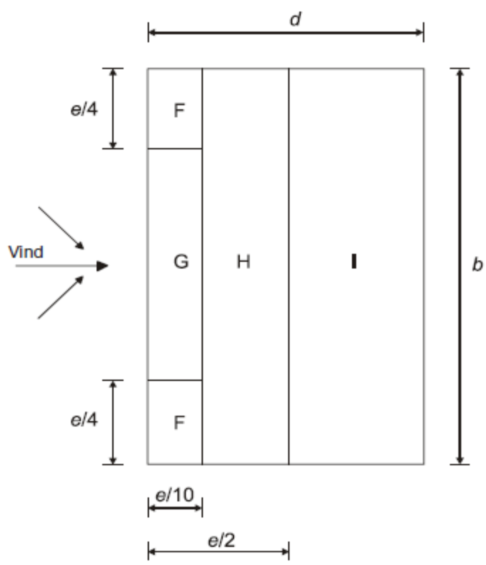


Formfaktor og vindlast, vindretning θ = 0°, Vind på facaden

Vindretning Værst

Parameteren e e = 45,0 m

		Tryk	Sug
Zone F	$c_{pe,10,F}$ =	-	-1,80
	$w_{k,F}$ =	-	-2,90 kN/m²
Zone G	$c_{pe,10,G}$ =	-	-1,20
	$w_{k,G}$ =	-	-1,93 kN/m²
Zone H	$c_{pe,10,H}$ =	-	-0,70
	$w_{k,H}$ =	-	-1,13 kN/m²
Zone I	$c_{pe,10,I}$ =	-	-
	$w_{k,I}$ =	-	0,00 kN/m²
Zone J	$c_{pe,10,J}$ =	-	-
	$w_{k,J}$ =	-	-
Middellast på tagflade	W_k =	-	-1,85 kN/m²

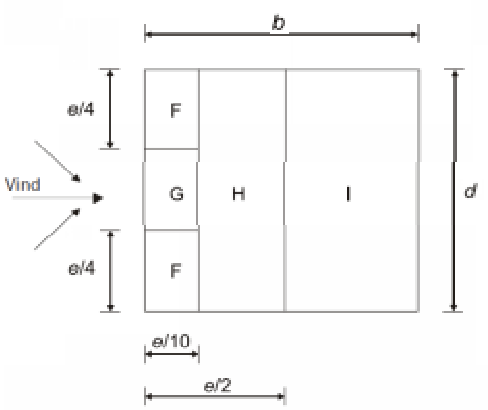


Vindlast på bygninger

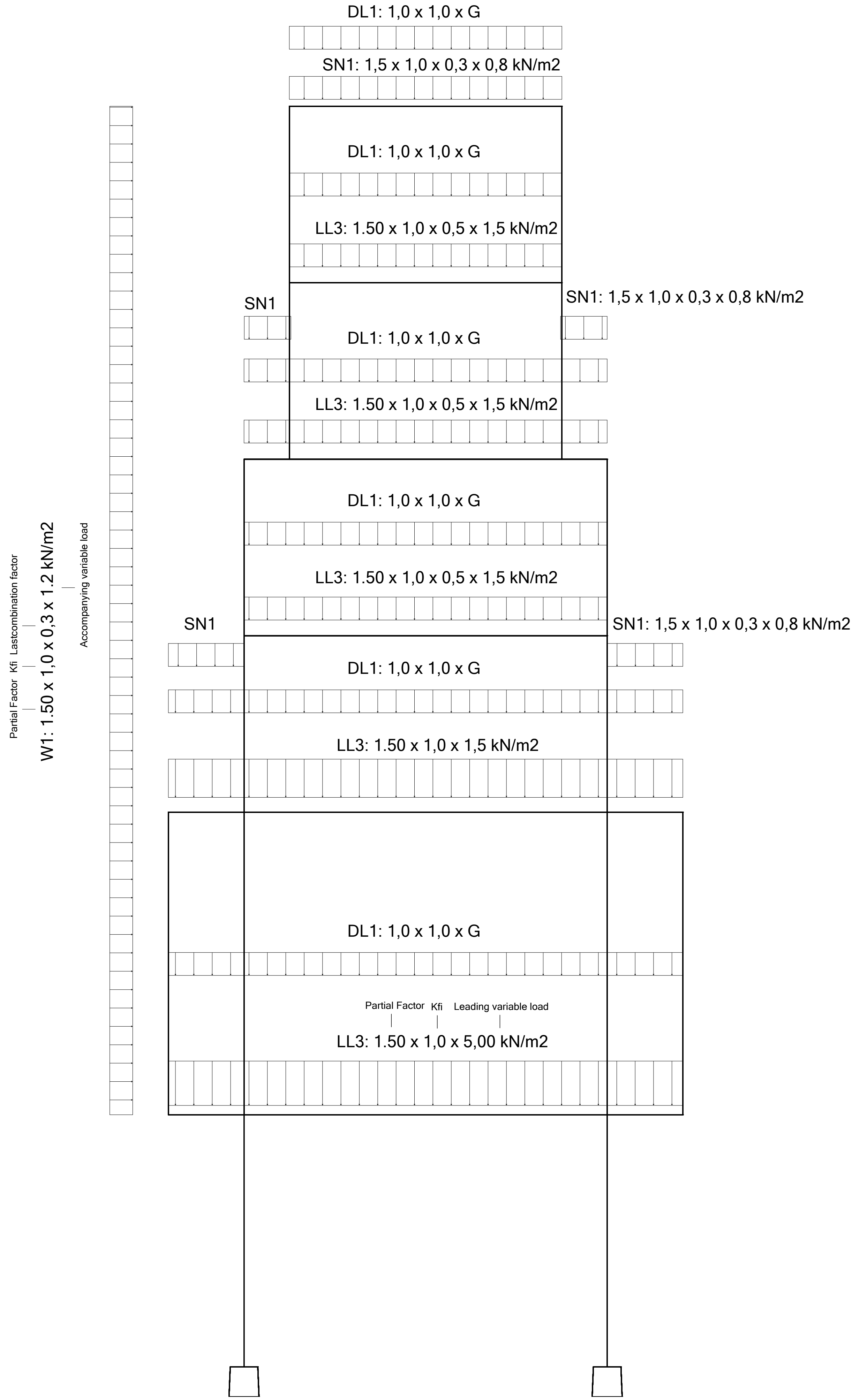
Formfaktor og vindlast, vindretning $\theta = 90^{o}$, Vind på gavlen

Vindretning		Værst	
Parameteren e		e =	8,0 m

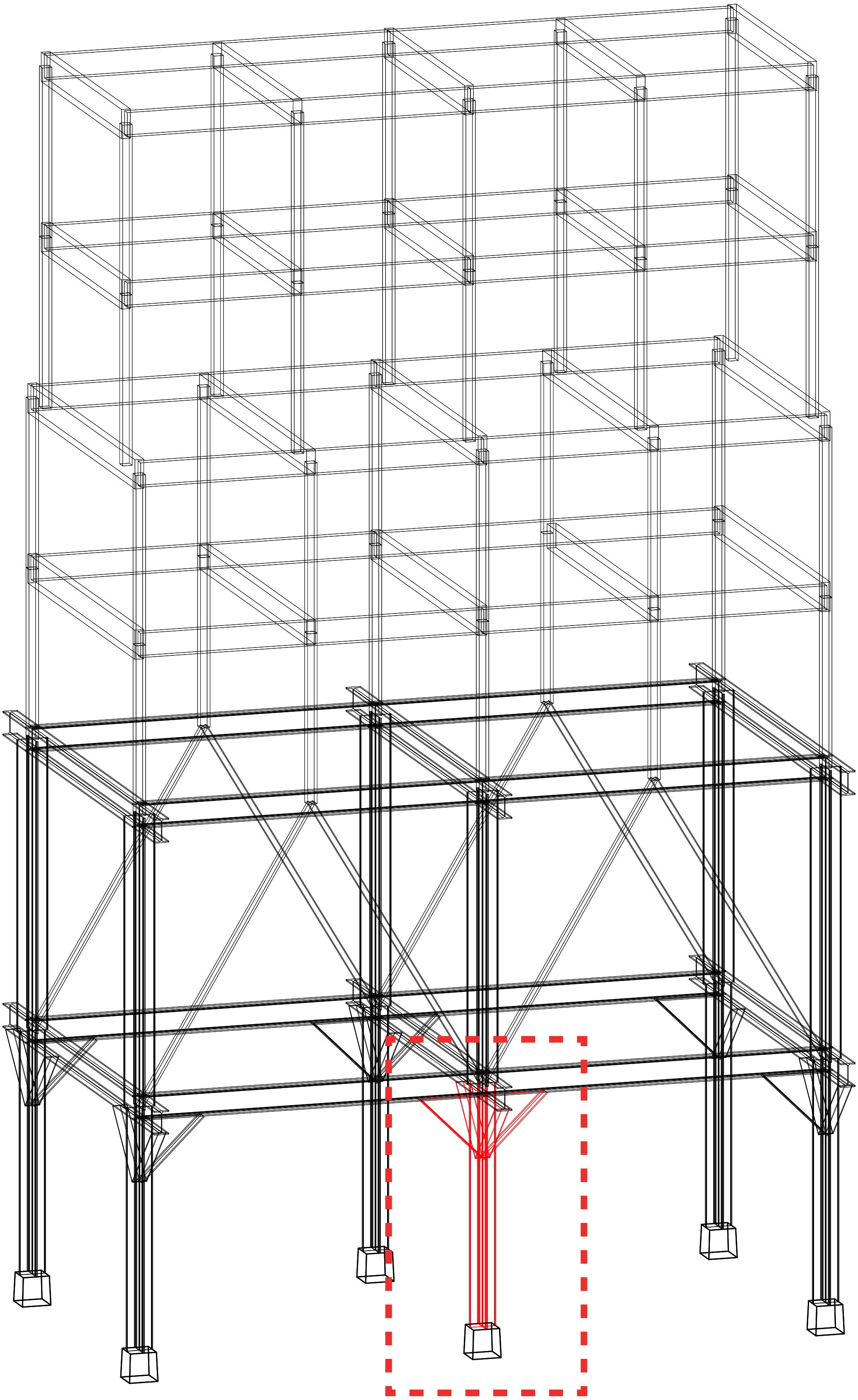
		Tryk	Sug
Zone F	$c_{pe,10,F}$ =	-	-1,80
	$w_{k,F}$ =	-	-2,90 kN/m²
Zone G	$c_{pe,10,G}$ =	-	-1,20
	$w_{k,G}$ =	-	-1,93 kN/m²
Zone H	$c_{pe,10,H}$ =	-	-0,70
	$w_{k,H}$ =	-	-1,13 kN/m²
Zone I	$c_{pe,10,I}$ =	0,20	-0,50
	$w_{k,I}$ =	0,32 kN/m²	-0,80 kN/m²
Zone J	$c_{pe,10,J}$ =	-	-
	$w_{k,J}$ =	-	-
Middellast på tagflade	F_{wk} =	0,17 kN/m²	-0,86 kN/m²



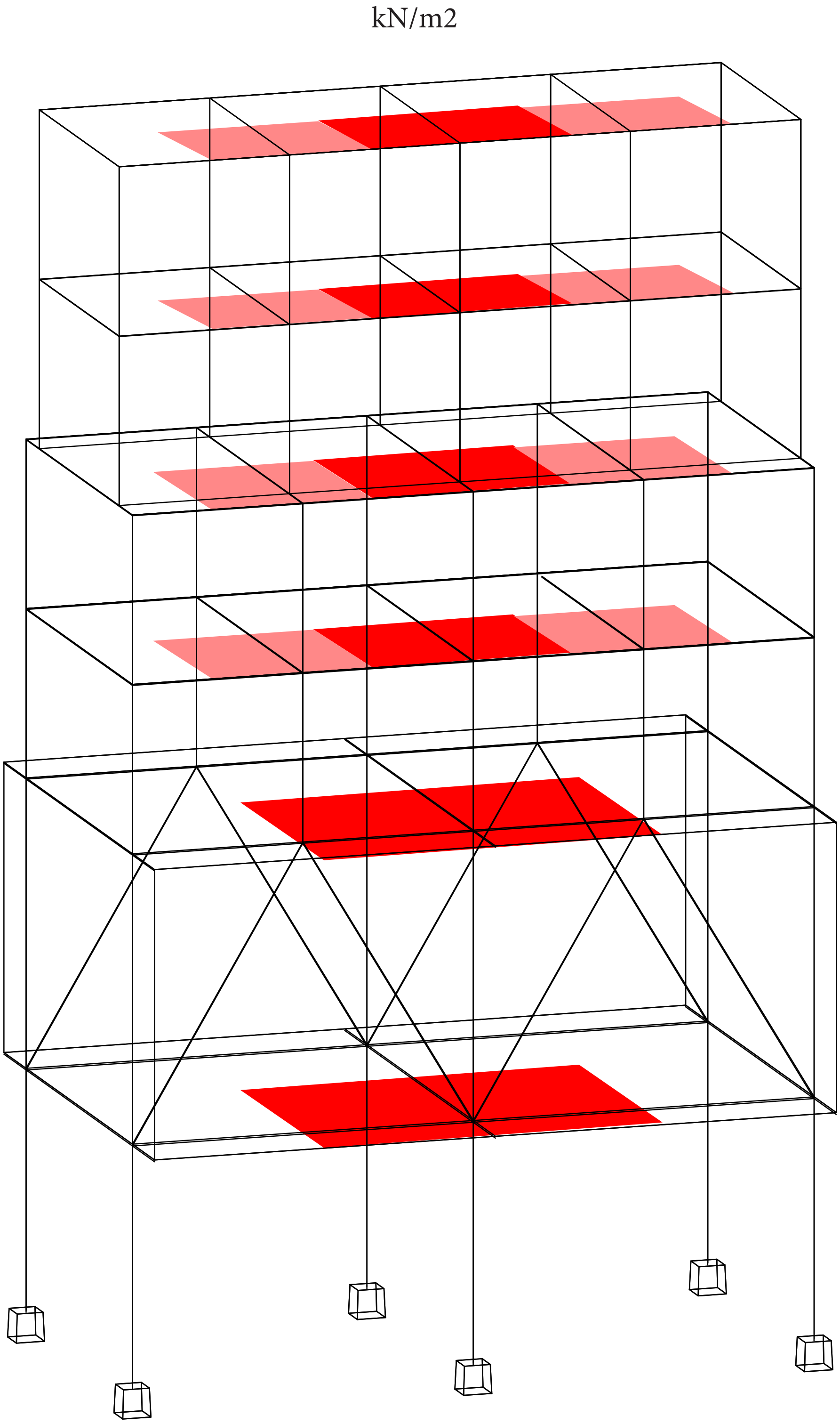
Applied loads

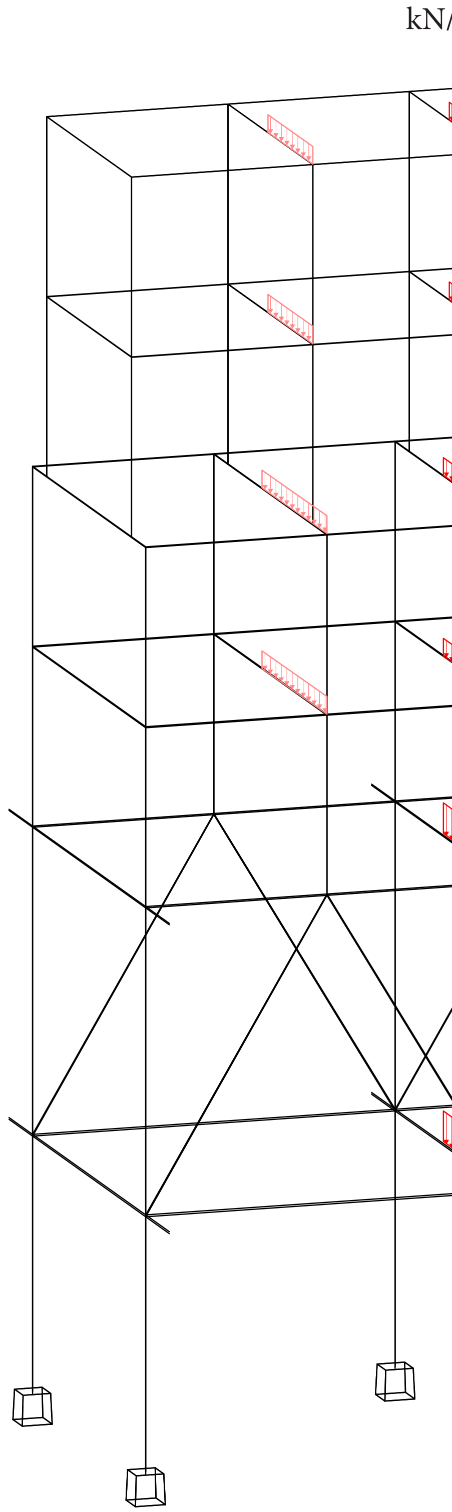


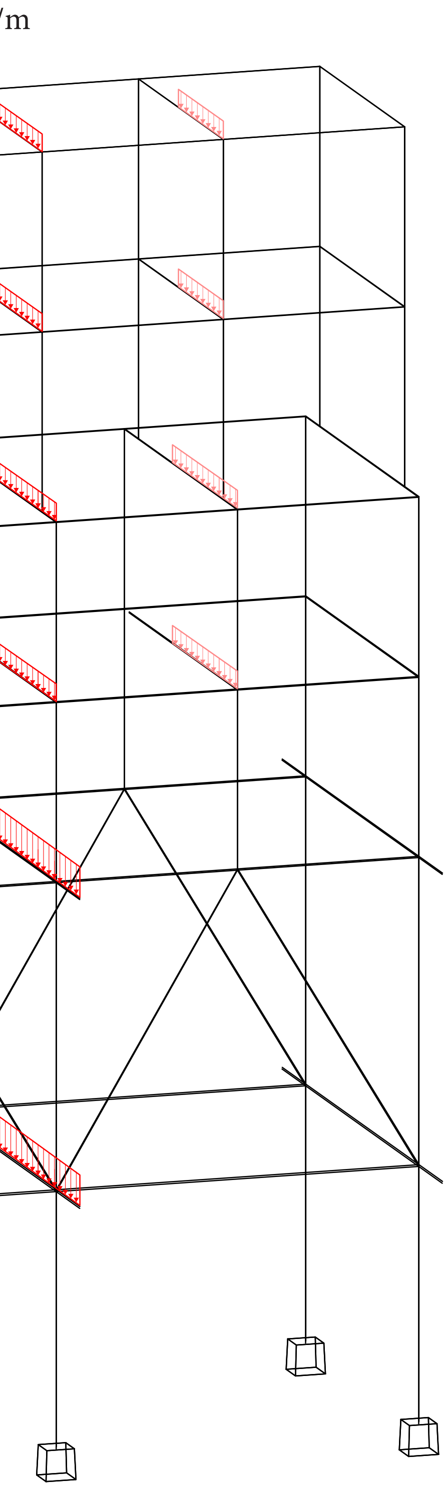
3D model in robot

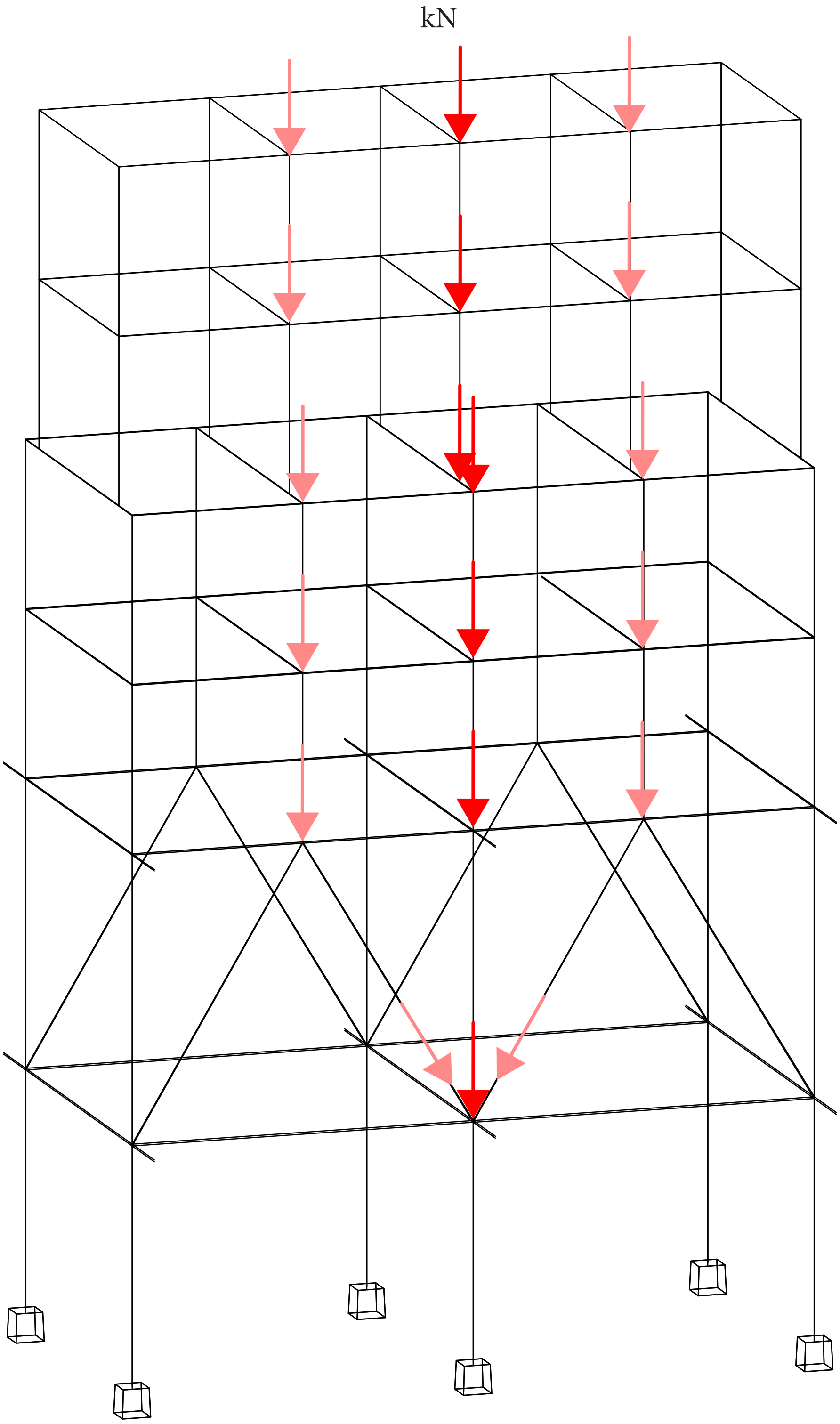


Load distribution

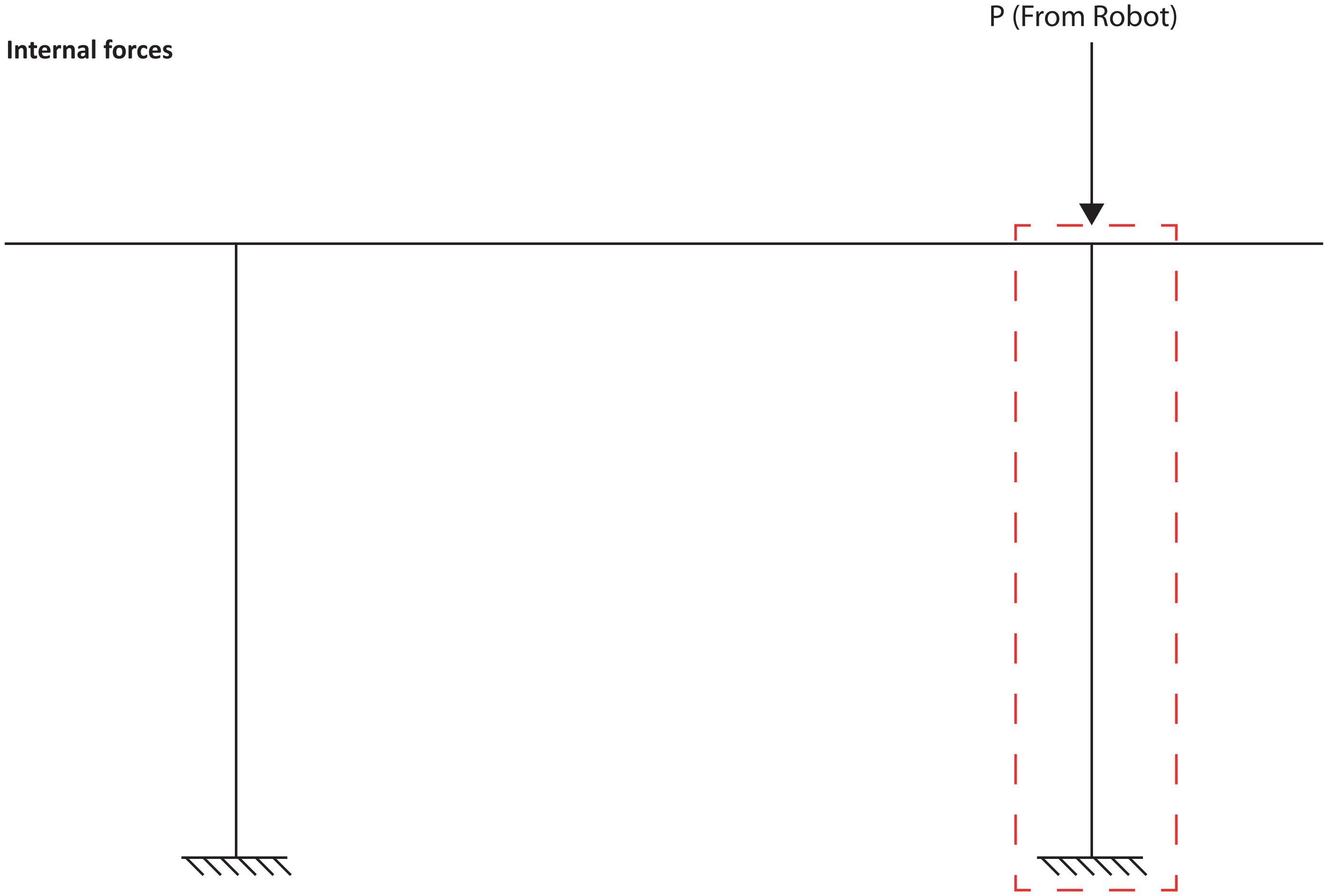


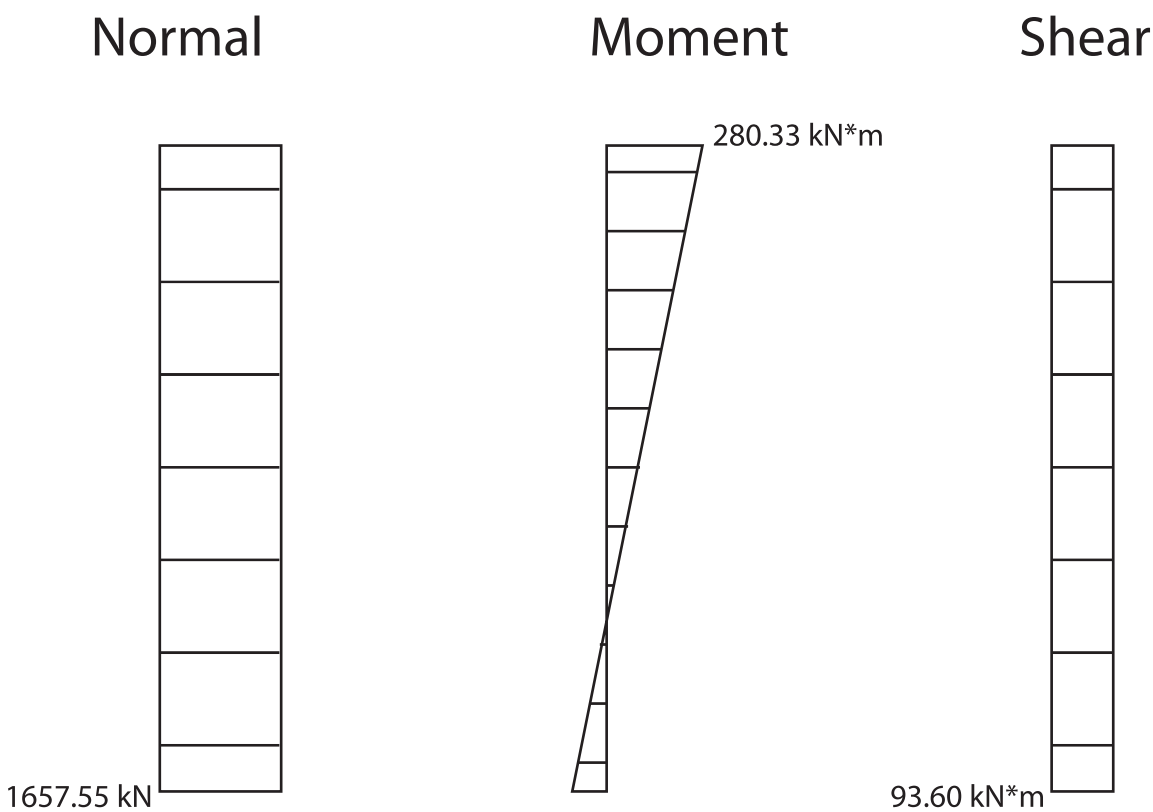



/m


kN

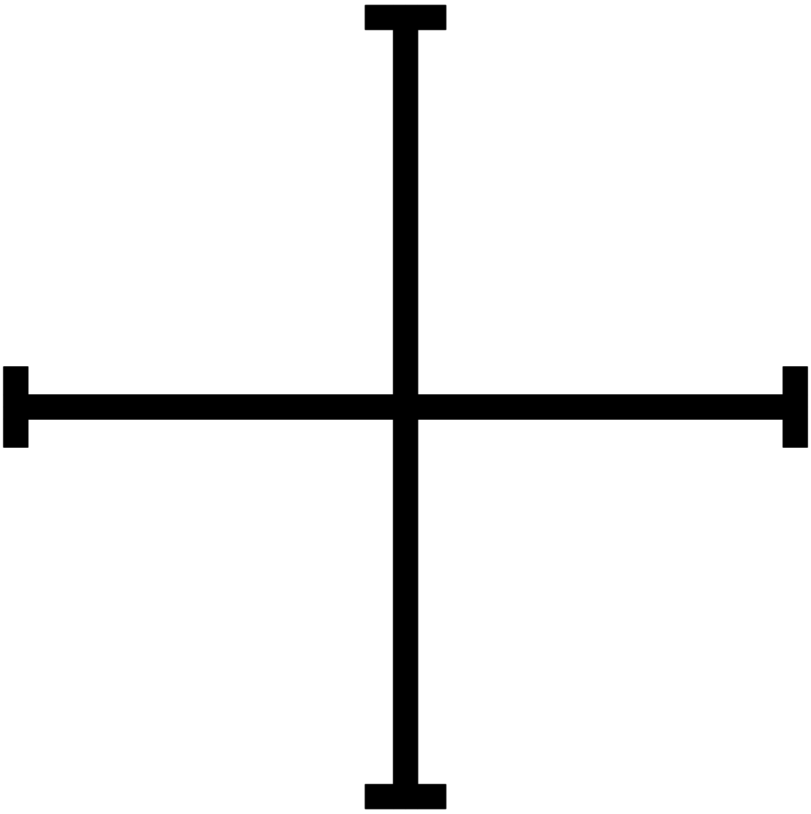
Internal forces





Cross-section properties

A_x	18000	mm^2	Cross section area
A_y	9000	mm^2	Shear Area (Y-axis)
A_z	9000	mm^2	Shear Area (Z-axis)
I_x	1275556	mm^4	Torsional constant
I_y	256190625	mm^4	Moment of inertia of a section about y-axis
I_z	276553125	mm^4	Moment of inertia of a section about z-axis
$W_{pl,y}$	1370625	mm^3	Plastic section modulus about the y (major) axis
$W_{pl,z}$	1438125	mm^3	Plastic section modulus about the z (major) axis
h	530	mm	Height of cross section
b	545	mm	Width of cross section
t_f	15	mm	Flange thickness
t_w	15	mm	Web thickness
r_y	119	mm	Radius of gyration (y-axis)
r_z	124	mm	Radius of gyration (z-axis)
A_{nb}	1.00		Net area to gross area ratio
E_{ta}	1.00		Factor for Av calculation

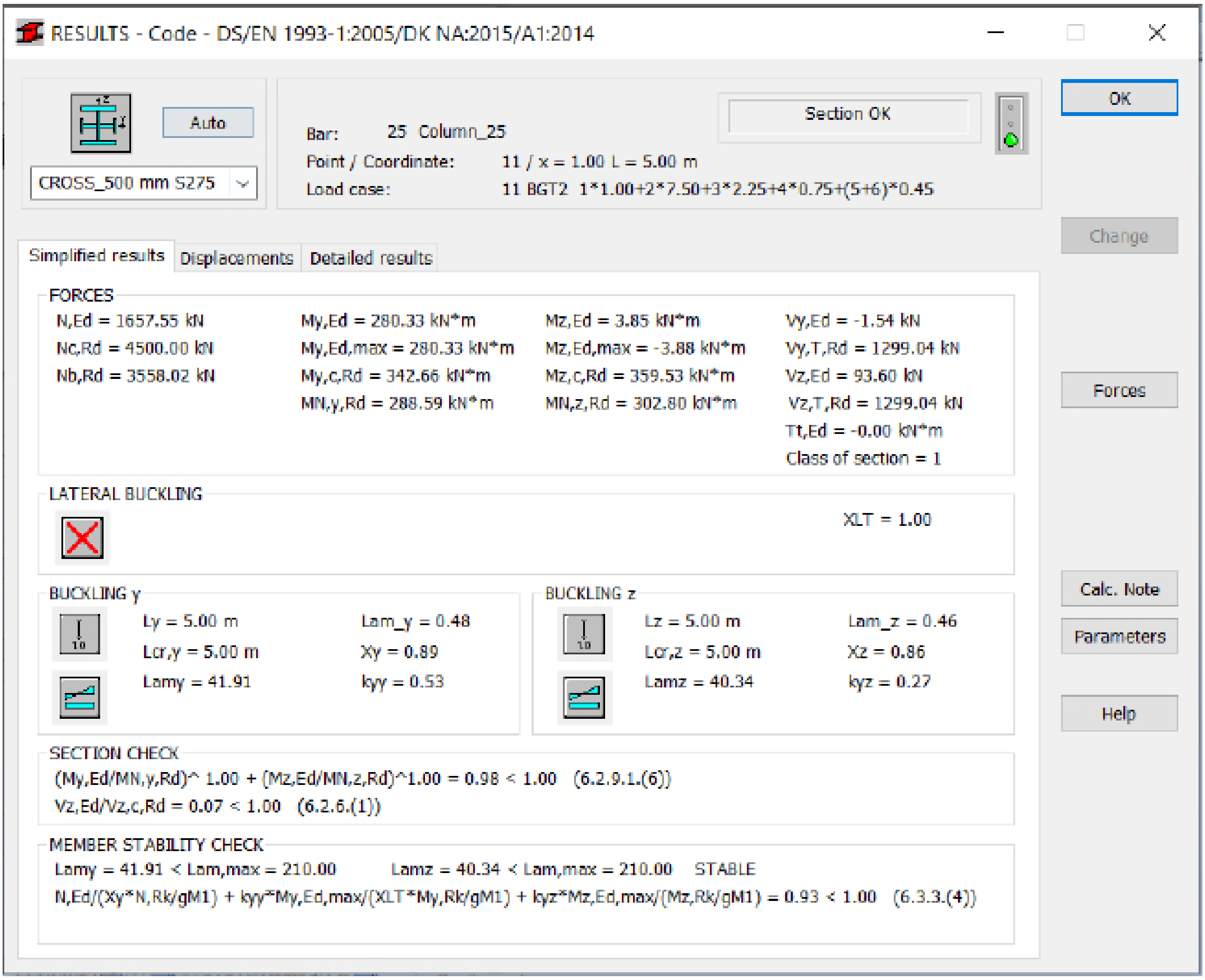


Material

f_y	275	MPa	Design yield strength of material	(3.2)
f_u	410	MPa	Limit tensile stress - characteristic value	(3.2)
γ_{M0}	1.0		Partial safety factor	(6.1.(1))*
γ_{M1}	1.2		Partial safety factor	(6.1.(1))*
γ_{M2}	1.35		Partial safety factor	(6.1.(1))*

* *DS-EN_1993 FU2009 Forkortet udgave af Eurocode 3 – Stålkonstruktioner*

Simplifed results from Robot - Steel Design



Section check

Section check for moment and normal forces

$$\left(\frac{My\_Ed}{MN\_y\_Rd}\right)^{1}+\left(\frac{Mz\_Ed}{MN\_z\_Rd}\right)^{1}<1$$

$My\_Ed := 280.33\ kN \cdot m$	Bending moment (y-axis)
$Mz\_Ed := 3.85\ kN \cdot m$	Bending moment (z-axis)
$MN\_z\_Rd := 302.80\ kN \cdot m$	Reduced design plastic resistance moment (About the z-axis of cross section) - (6.2.9.1)
$MN\_y\_Rd := 288.59\ kN \cdot m$	Reduced design plastic resitance moment (About the y-axis of cross section) - (6.2.9.1)

$$\left(\frac{My\_Ed}{MN\_y\_Rd}\right)^{1}+\left(\frac{Mz\_Ed}{MN\_z\_Rd}\right)^{1}=0.984$$

$0.984<1$ OK!

SECTION CHECK
(My,Ed/MN,y,Rd)^ 1.00 + (Mz,Ed/MN,z,Rd)^1.00 = 0.98 < 1.00 (6.2.9.1.(6))
Vz,Ed/Vz,c,Rd = 0.07 < 1.00 (6.2.6.(1))

Section check for shear

$Vz\_Ed := 93.60\ kN$	Shear force
$Vz\_c\_Rd := 1299.04\ kN$	Design plastic shear resistance

$$\frac{Vz\_Ed}{Vz\_c\_Rd}=0.072$$

$0.072<1$ OK!

SECTION CHECK
(My,Ed/MN,y,Rd)^ 1.00 + (Mz,Ed/MN,z,Rd)^1.00 = 0.98 < 1.00 (6.2.9.1.(6))
Vz,Ed/Vz,c,Rd = 0.07 < 1.00 (6.2.6.(1))

Member stability check

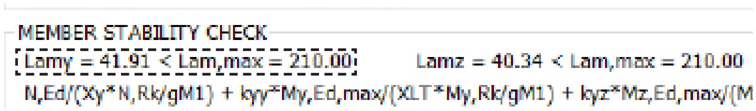
Buckling y

$Ly := 5\ m$	Buckling lenght
$Lcr\_y := 5\ m$	Effective Buckling lenght - (6.3.1.21(1))
$Lamy := 41.91$	Slenderness ratio - (6.3.1.21(1))
$Lam\_y := 0.48$	Non-dimensional slenderness ratio for buckling - 6.3.1.21(1))
$Xy := 0.89$	Reduction factor for buckling - 6.3.1.21(1))
$kyy := 0.53$	Interaction parameter

$Lamy < Lam\_Max$

$Lamy = 41.91$ $\quad$ $Lam\_Max := 210$

$41.91 < 210$ $\quad$ **Stable!**

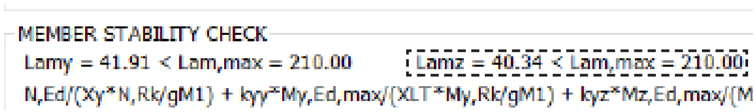


Buckling z

$Lz := 5\ m$	Buckling lenght - (6.3.1.21(1))
$Lcr\_y := 5\ m$	Effective Buckling lenght - (6.3.1.21(1))
$Lamy := 40.34$	Slenderness ratio - (6.3.1.21(1))
$Lam\_z := 0.46$	Non-dimensional slenderness ratio for buckling - (6.3.1.21(1))
$Xz := 0.86$	Reduction factor for buckling - (6.3.1.21(1))
$kyz := 0.27$	Interaction parameter

$Lamz < Lam\_Max$

$40.34 < 210$ $\quad$ **Stable!**



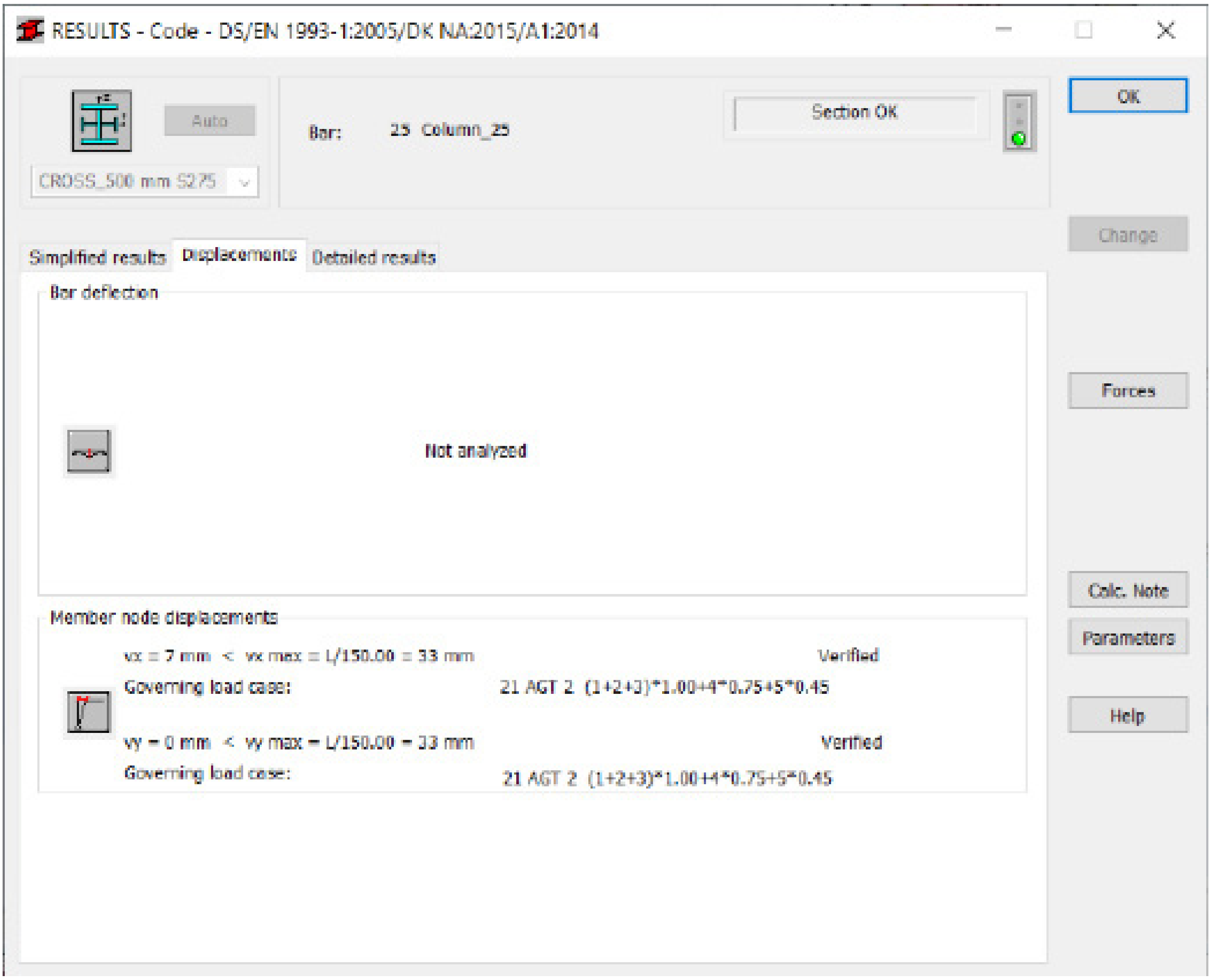
Bøjnings- og trykpåvirkede elementer med konstant tværsnit

$A\_x := 18000\ mm^2$	Cross-section area
$A\_y := 9000\ mm^2$	Shear area - y-axis
$A\_z := 9000\ mm^2$	Shear area - x-axis
$W\_ply := 1370625\ mm^3$	Plastic section modulus about the y (major) axis
$W\_plz := 1438125\ mm^3$	Plastic section modulus about the z (Minor) axis
$f\_y := 275\ MPa$	Design yield strength of material - (3.2)
$N\_ed := 1657.55\ kN$	Axial force
$Xy := 0.89$	Reduction factor for buckling - (6.3.1.2(1))
$gM1 := 1.2$	Partial safty factor (Normal control class) - (6.1.(1))
$N\_Rk := f\_y \cdot A\_x = 4950\ kN$	karakteristisk værdi af bæreevne mht. trykpåvirkning - (6.3.3)
$kyy := 0.53$	Interaction parameter
$My\_Ed\_max := 280.33\ kN \cdot m$	Maximal moment
$XLT := 1.00$	Reduction factor for lateral-torsional buckling - (6.3.2.2(1))
$My\_Rk := f\_y \cdot W\_ply = 376.922\ kN \cdot m$	karakteristisk værdi af bæreevne mht. bøjningsmomenter omkring y-y-aksen - (6.3.3)
$kyz := 0.27$	Interaction parameter
$Mz\_Ed\_max := -3.88\ kN \cdot m$	Maximal moment
$Mz\_Rk := f\_y \cdot W\_plz = 395.484\ kN \cdot m$	karakteristisk værdi af bæreevne mht. bøjningsmomenter omkring z-z-aksen - (6.3.3)

$$\left(\frac{N\_ed}{\frac{(Xy \cdot N\_Rk)}{gM1}}\right) + \frac{kyy \cdot My\_Ed\_max}{\left(\frac{(XLT \cdot My\_Rk)}{gM1}\right)} + kyz \cdot \frac{Mz\_Ed\_max}{\frac{(Mz\_Rk)}{gM1}} = 0.921$$

```
MEMBER STABILITY CHECK
Lamy = 41.91 < Lam,max = 210.00        Lamz = 40.34 < Lam,max = 210.00    STABLE
N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) + kyz*Mz,Ed,max/(Mz,Rk/gM1) = 0.93 < 1.00  (6.3.3.(4))
```

Simplifed results from Robot - Steel Design



Member node displacement

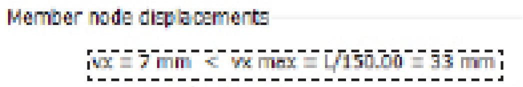
Member displacement along X axis

$vx := 7\ mm$ Member displacement along X axis

$vx_{max} = \dfrac{L}{150}$ Allowable member displacement along X axsis

$L := 5\ m$ Equal to L_{cr}

$$vx_{max} := \frac{L}{150} = 33.3\ mm$$



$Ratio_{vx} := \dfrac{vx}{vx_{max}} = 0.21$ Efficiency ratio

Member displacement along y axis

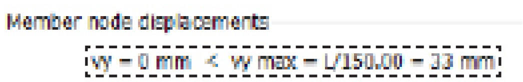
$vy := 0\ mm$ Member displacement along y axis

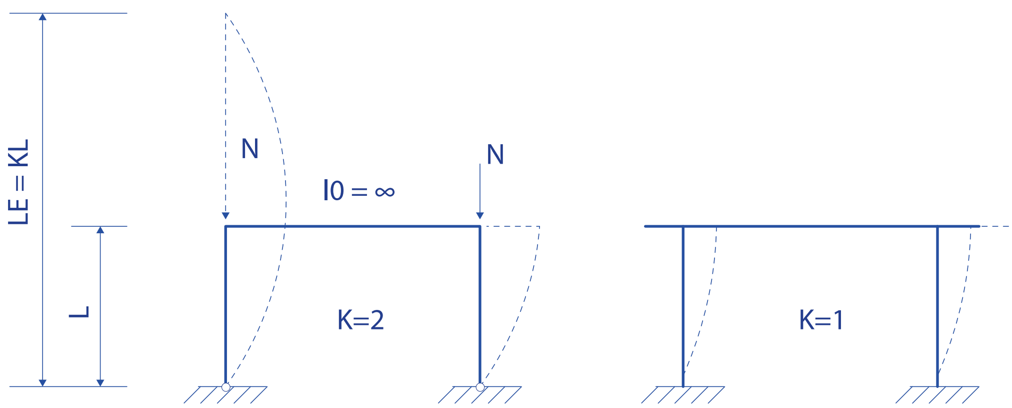
$vy_{max} = \dfrac{L}{150}$ Allowable member displacement along y axsis

$L := 5\ m$ Equal to L_{cr}

$$vy_{max} := \frac{L}{150} = 33.3\ mm$$

$Ratio_{vx} := \dfrac{vy}{vy_{max}} = 0$ Efficiency ratio





Appendix B: Indoor Environments goals and methods

Overall goal
Iterations and investigation on indoor environment conditions has been conducted as design drivers to increase the desire of an integrated design process, hence to boost the design process, especially the facade design. This to be able to produce realistic proposals motivated by specific data results of both dynamic and static simulations.
The following indoor environment aspects will be examined; atmospherical, thermal and visual.

Delimitations
It is in general desired to actively through the design process use inputs from the results of calculations and simulations to generate a more critical design thinking, which eventually could boost the creativity in an integrated and holistic manner. The goal is not to make detailed set-ups and models to conduct results only as check-points of achieved indoor environmental conditions.

Basis of calculations
In general the foundation of all calculations and simulations is based on minimum requirements and relevant standards in international ISO/European Standards.
The expectations for this building concerning indoor environment is 'normal', as it is considered as a standard construction with requirements referring to category II (Dansk standard, 2007, DS/EN 15251, side 13)

Programs and tools
The calculations and simulations are conducted based primarily on dynamic calculations using the tool BSim. These dynamic indoor environment simulations are based on construction compositions in accordance with energy performance calculations conducted in Be18. Additionally the simulations are based on relevant 'systems' in BSim specifically defined based on the target room of interest. This will be reported with the results of the simulations. The simulation is based on the calendar year 2010 with location: FRA_Paris.Orly.071490.
In addition the Plugin tool Ladybug for Grasshopper is used in an iterative and parametric way to investigate the daylight conditions in relation to the simulations in BSim.

Requirements specification

Aspect	Category: II, 2, B	Reference
Atmospheric conditions *CO2 concentrations above outdoor concentration*	500 ppm	DS_EN 15251: Annex B, table B.4
Thermal conditions *operative temperature *C* *summer* *winter* *level of tolerance* *transgression of operative temp.* *non-residential* *above 26 *C* *above 27 *C* *residential* *above 27 *C* *above 28 *C*	24,5 ± 1,5 22,0 ± 2,0 100 hours 25 hours 100 hours 25 hours	DS/CEN/CR 1752:2001, Tabel 1 (BR18 (§ 385 - § 392), 1.0
Visual conditions *lighting*	300-500 lux	DS_EN 15251: Annex D, tabel 1.D

Rooms of investigation
Three rooms are selected for investigation of the indoor environment in iterations with energy performance design and the overall design of the building facade. Especially the relation of climate envelope, windows and the importance of solar shading is in focus.

Rooms:
Apartments: One Small standard apartment is tested as this is assessed to be the most critical situation compared to larger apartments.
Shared: The shared space as a whole, as it is expected to be occupied by a lot of people, and because the architectural intention is to have a very transparent expression. The whole space is simulated as one because the intention is to create a rather open and flexible environment.

Appendix C: BSim type-in and inputs

The following appendix is an overview of BSim inputs concerning Systems, controls and schedules.

Systems

People load

Activity level, sitting still (office): 1,2 met

Total [W/person]	Sensible heat [W/person]	Latent heat [W/person]
118 W = 0,118 kW	76 W = 0,076 kW	42 W = 0,042 kW

Activity level, lying: 0,8 met

Total [W/person]	Sensible heat [W/person]	Latent heat [W/person]
79 W = 0,079 kW	56 W = 0,056 kW	23 W = 0,023 kW

Infiltration

The infiltration is calculated due to SBI 213 section 6.2 *Infiltration* (SBI 213 p. 74) in the service hours:

$$I_{\text{service hours}} = 0{,}04 + 0{,}06 \text{ x } q_{50} \text{ l/s per m}^2 \text{ heated floor area}$$

q_{50} is the ventilation in l/s per m^2 heated floor area at a pressure test with 50 Pa.

For buildings heated to 15°C or more, the flow rate through leakage must not exceed 1,0 [l/s per m^2] heated floor area at a precure difference of 50 Pa [2] (Trafik-, Bygge- og Boligstyrelsen, 2018 (§ 250 - § 298), § 263).

The infiltration in the service hours can be calculated:

$$I_{\text{service hours}} = 0{,}04 + 0{,}06 \text{ x } 1{,}0 \text{ [l/s per m}^2\text{]} = 0{,}1 \text{ [l/s per m}^2\text{]}$$

Conversion from [l/s per m^2] to [h^{-1}]:

$$0{,}1 \text{ [l/s per m}^2\text{]} * 1850 \text{ [m}^2\text{]} = 185 \text{ [l/s]}$$

$$185 \text{ [l/s]} * 3{,}6 \text{ [m}^3\text{*s / l*h]} = 666 \text{ [m}^3\text{/h]}$$

$$666 \text{ [m}^3\text{/h] / } 7150 \text{ m}^3 = 0{,}09 \text{ h}^{-1}$$

The infiltration is 0,09 h^{-1}

Heating

It is estimated that radiators with an efficiency of 1,5 kW are placed in the apartment. One radiator is placed in total in the small apartment. The setpoint is set at 22°C. This is the temperature that is wished to maintain in the dwelling. This temperature is estimated due to the diagram *"komforttilstande ved RF=0,5 og lufthastighed < 0,1 m/s"* (Larsen, T. S. 2019, page 27). It is seen that wearing 0,8 clo of clothing and with an activity level of 1,2 met, the preferred temperature is 24°C +- 2°C.)

The recommended design values of the indoor temperature for design of building is minimum 20,0°C for heating in the winter season when wearing 1,0 clo and having an activity level of 1,2 met (DS/EN 15251 s. 26).

Fixed Part is estimated to 0 as this is a non adjustable radiation of heat. Part To Air - how much the emission of heat of the radiator is conveyed to the room air by convection - the BSim manual expresses that a normal radiator placed by the exterior wall near a window, has a value between 0,5 and 0,7. An average of 0,6 is used (Statens Byggeforskningsinstitut, u.å.).

Mechanical ventilation

The building regulations requirements for minimum fresh air supply is 0,30 l/s per m^2.

This value is adjusted to the calculations below.

Natural ventilation

To ensure indoor air quality, calculations have been made of the carbon emissions and the sensoric pollution to establish the needed air change rate. In addition, the calculations will follow the recommendations for category 2 or B (Dansk standard. 2007. *DS/EN 15251 p. 32)*.

Info about the room
People: 2
Activity level: Sitting - 1.2 met - 1 olf/person
Sqm: 25 sqm
Height of room: 2.7 m

Venting due to carbon dioxide emissions:
The calculations are based on the following equation

$$c = \frac{q_{co2}}{n * V_R} + c_1$$

c: the concentration of pollution in m^3/m^3
c_1: the concentration of pollution in the outside air in m^3/m^3, this is assumed to 350 ppm - 0.00035 m^3/m^3
q_{co2}: the pollution pr. person calculated by $17\frac{L}{h} * activity\ in\ met * number\ of\ people$
n: air change rate
V_R: volume of the room

According to the DS/EN 15251 table B.4 page 36, the maximum pollution should be 500 ppm (0.00050 m^3/m^3) above the pollution in the outdoor air (Dansk standard. 2007. *DS/EN 15251).*

$$c = 0.00050\frac{m^3}{m^3} + 0.00035\frac{m^3}{m^3} = 0.00085\frac{m^3}{m^3}$$

The pollution inside is calculated to the following

$$q_{co2} = 17\frac{L}{h} * 1.2 * 2 = 40.8\frac{L}{h} \rightarrow q_{co2} = 40.8\frac{L}{h} * \frac{1m^3}{1000L} = 0.0408\frac{m^3}{h}$$

The needed air change rate can therefore be calculated by the following

$$n = \frac{q_{co2}}{V_R*(c-c_1)}$$

$$n = \frac{0.0408\frac{m^3}{h}}{(25m^2*2.7m)*(0.00085\frac{m^3}{m^3}-0.00050\frac{m^3}{m^3})} = 1.72h^{-1}$$

Venting due to sensoric pollution:
The calculations are based on the following equation

$$c = 10 * \frac{q_{olf}}{V_L} + c_1$$

c: the concentration of pollution in decipol
c_1: the concentration of pollution in the outside air in m^3/m^3, this is assumed to be 0
q_{olf}: the pollution pr. hour in olf
V_L: air flow in m^3/h

According to the DS/CEN/CR 1752 table A.5 a maximum pollution of 1.4dp is recommended

$$c = 1.4dp$$

The pollution inside is calculated to the following as it is assumed that the olf pr. person is 1 (DS 1752 table A.6 page 26) and the pollution from the room, furniture ect. is 0.1 olf pr. smq floor (DS 1752 table A.8 page 27).

$$q_{olf} = 2 * \frac{olf}{person} + 25m^2 * 0.1\frac{olf}{m^2} = 4,5olf$$

The needed air flow can therefore be calculated by the following

$$V_L = 10 * \frac{3.45olf}{1.4dp} = 32,1\frac{L}{s} \rightarrow V_L = 25.3\frac{L}{s} * \frac{1m^3}{1000L} * \frac{3600s}{1h} = 115,7\frac{m^3}{h}$$

Therefore the air change rate is

$$n = \frac{91.08\frac{m^3}{h}}{25.4m^2*2.3m} = 1.71h^{-1}$$

Equipment:

Electricity profiles for BSim

Annual electricity use is estimated to be 1725 kWh including the energy use for appliances and lighting.

Max hourly use: 0,19 kWh

Controls and Schedules

System	Schedule	
	Control	Time
Equipment	Day Profile *Weekend* *100%23-7* *25%8-22* *Workdays* *100%22-7* *25%17-21*	Weekend mon-fri
Heating	HeatCoolCtl Factor: 1 SetPoint: 22 Designtemp: -12 C MinPow: 0 Te min: 17 C	Heating season Jan-April + Sep-Dec
Infiltration	Day Profile 100%0-24	Always
People Load	Day Profile *Weekend* *100%23-7* *25%8-22* *Workdays* *100%22-7* *25%17-21*	Weekend mon-fri
Ventilation	VAV-ctrl VAV max factor: 3 Min Inlet Temp:18 C Max inlet temp: 24 C Setp Indoor Air: 20 C Setp Cooling: 25 C Setp CO2: 800 ppm Air Hum: 0 kg/kg (da ingen befugter)	Heating season Jan-April + Sep-Dec
Venting	Venting-ctrl SetPoint: 23 SetP CO2: 800 Factor: 1	Cooling season March-Oct
Shading Shading Coeff.: 0,5 (overruled by Solar Ctrl) Max sun (W/m2): 150 Max wind (m/s: 30	Solar Ctrl Shading Coeff.: 0,1 (overrules the SolarShading) *changes through iterations* Max sun (W/m2): 100 (overrules the SolarShading) Delta sun (W/m2): 100 Temp. Max (*C): 20 Control form: Continuous	Always 8-17

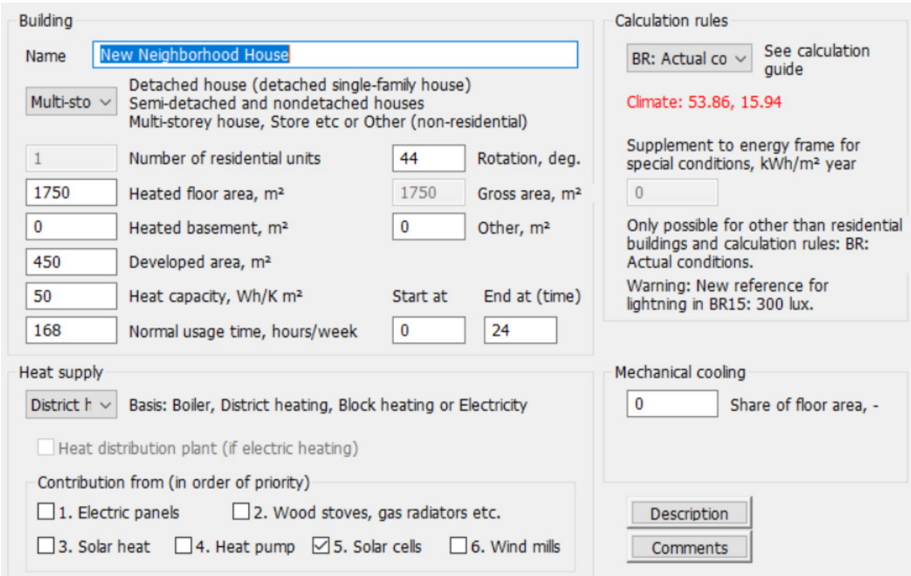
Appendix D: Energy performance: Be18

Be18 has been used as a tool to calculate the expected energy consumption for the Neighborhood House. The house invites the neighborhood to use the facilities 24 hours of the day, hence the use is defined more like a dwelling than 'other building'. The program is not set-up in every detail as it is not used as a final calculation of the energy performance.

The building

The house has a heated floor area of 1750 sq. m and is constructed as combined steel and wood frame construction with light facade elements. It is assumed that the heat capacity is low around a value of 50 Wh/km2. The house will be connected to the district heating system with additional photovoltaics on the roof as a renewable source.

The house is rotated 44 degrees clockwise.



Climate envelope

Exterior wall, floor and roof

The values used for the transmission coefficient are based on a standard light wood-frame construction with around 300-380 mm insulation, this will result in a u-value around 0,12 W/m^{2}K. The climate envelope for use in Be18 is an estimation of general solutions rather than detailed solutions.

	External walls, roofs and floors	Area (m²)	U (W/m²K)	b	Ht (W/K)	Dim.Inside ((	Dim.Outside	Loss (W)
		2437		CtrlClick	292,44			9358,08
+1	Walls	1450	0,12	1,00	174	20	-12	5568
2	Roof	470	0,12	1,00	56,4	20	-12	1804,8
3	Floor	517	0,12	1,00	62,04	20	-12	1985,28

Foundation and assembling at windows

The linear thermal transmittance around windows are identified as 0.001 W/mK due to insulation inside the window frame (Brunsgaard, Heiselberg and Jensen, 2008). Furthermore, it is assumed that it is possible to improve the linear loss around the foundation to 0,12 W/mK and the roof to 0,1 W/mK. This is an improvement from the minimum requirements of the building regulations (Trafik, bygge- og boligstyrelsen, 2018a).

	Foundations and joints at windows	l (m)	Loss (W/mK)	b	Ht (W/K)	Dim.Inside ((	Dim.Outside	Loss (W)
		1274		CtrlClick	52,358			1675,46
+1	Fundament	116	0,1	1,00	11,6	20	-12	371,2
2	Vinduer	758	0,001	1,00	0,758	20	-12	24,256
3	Roof	400	0,1	1,00	40	20	-12	1280

Windows, exterior doors, and shadows

Window: Velfac 200 Energy with Velfac Standard pane.
Info: (Velfac, s. d.)
u-value (whole window): 0,82 W/m^{2}K and the
g-value(pane): 0,52.
Glass area: 0,8 (80%).

The windows are divided into different orientations and placements. The horizon is calculated due to shadowing context and the shadows are calculated according to SBi 213.

	Windows and outer doors	Numbe	Orient	Inclinatio	Area (m²)	U (W/m²K)	b	Ht (W/K)	Ff (-)	g (-)	Shading	Fc (-)	Dim.Insid	Dim.Outs	Loss (W)	Ext
		67			523,5		CtrlClick	429,27			CtrlClick				13736,6	0/1
+1	Lejlighed syd	38	S	90	5,25	0,82	1,00	163,59	0,8	0,53		0,1			5234,88	0
2	Lejlighed N	25	N	90	2	0,82	1,00	41	0,8	0,53		0,1			1312	0
3	Shared S	1	S	90	100	0,82	1,00	82	0,8	0,53	SHARED	0,1			2624	0
4	Shared N	1	N	90	100	0,82	1,00	82	0,8	0,53	SHARED	0,1			2624	0
5	Shared Ø	1	Ø	90	37	0,82	1,00	30,34	0,8	0,53	SHARED	0,1			970,88	0
6	Shared V	1	V	90	37	0,82	1,00	30,34	0,8	0,63	SHARED	0,1			970,88	0

Ventilation

The house is divided into ventilation zones with conditions like; the apartments and the shared functions. Mechanical ventilation is used in the winter season to gain the advantage of heat recovery. In the summer months, natural ventilation is used to minimize the use of electricity used for a ventilation system.

Mechanical ventilation during winter and summer

The values for the airflow for the mechanical ventilation is calculated due to sensory comfort [decipol] where the requirement is 1 decipol in comfort category I/A (Dansk standard, 2007, DS/EN 15251, page 13). See method for calculation in Appendix C

Thermal efficiency

To minimize the energy consumption a heat recovery system is used for heating the fresh outside air. It is assumed that the thermal efficiency is 80%.

SEL – The specific electricity consumption for air transport

In relation to the danish building regulation the SEL-value for a dwelling with constant air change is 1,0 kJ/m^3 and 1,0 kJ/m^3 for variable air change (Trafik-, Bygge- og Boligstyrrelsen, 2018b). It is chosen to use the values from the dwelling instead of another building than dwelling because the house resembles a dwelling.

	Ventilation	Area (m²)	Fo, -	qm (l/s m²)	n vgv (-)	ti (°C)	El-HC	qn (l/s m²)	qi,n (l/s m²)	SEL (kJ/m³)	qm,s (l/s m²	qn,s (l/s m²)	qm,n (l/s m²	qn,n (l/s m²)
	Zone	1454		Winter			0/1	Winter	Winter		Summer	Summer	Night	Night
+1	Shared	450	1	1,6	0,8	18	0	0	0	1	1,6	3	0	0
2	Apartment	904	1	1,3	0,8	18	0	0	0	1	1,3	3	0	0
3	trapper	100	1	0	0	0	0	0	0	0	0	0	0	0

Internal heat supply

Persons

It is estimated that the heat load from the persons are compliant with the recommendations from SBi 213 of a value of 1,5 W pr. sq. m.

Equipment

It is assumed that the heat load from the equipment and lightning are compliant with the recommendations from SBi 213 of a value of 3,5 W pr. sq. m. for dwellings and 6 W pr. sq. m. for the shared functions.

	Internal heat supply	Area (m²)	Persons (W/m²)	App. (W/m²)	App.night (W/m²)
	Zone	1450,0	2175,0 W	6450,0 W	0,0 W
+1	Dwelling	900	1,5	3,5	0
2	Shared	550	1,5	6	0

Solar cells

The photovoltaic is placed on the roof towards the south for all three dwellings. The values
for the photovoltaics are based on monocrystalline photovoltaics from KlimaEnergi (KlimaEnergi s. d.)

Description: Nyt solcelle anlæg

Solar cells

200	Panel areal, m²
0,172	Peak Power (RS), kW/m²
0,85	System efficiency (Rp), -

Orientation and shadows

SW	Orientation, S, SE, E, ...		
45	Slope, °, 0, 10, 20, 30, ...		
0	Horizon cutoff, °		
0	Left shadow, °	0	Right shadow, °

Results

Key numbers, kWh/m² year

	Without supplement	Supplement for special conditions	Total energy frame
Renovation class 2	71,3	0,0	71,3
Total energy requirement			22,2
Renovation class 1	53,4	0,0	53,4
Total energy requirement			22,2
Energy frame BR 2018	30,6	0,0	30,6
Total energy requirement			22,2
Energy frame low energy	27,0	0,0	27,0
Total energy requirement			22,2

Contribution to energy requirement		Net requirement	
Heat	32,1	Room heating	32,1
El. for operation of bulding	-2,7	Domestic hot water	0,0
Excessive in rooms	0,0	Cooling	0,0

Selected electricity requirements		Heat loss from installations	
Lighting	0,0	Room heating	0,0
Heating of rooms	0,0	Domestic hot water	0,0
Heating of DHW	0,0	**Output from special sources**	
Heat pump	0,0	Solar heat	0,0
Ventilators	9,5	Heat pump	0,0
Pumps	0,0	Solar cells	12,2
Cooling	0,0	Wind mills	0,0
Total el. consumption	41,8		

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