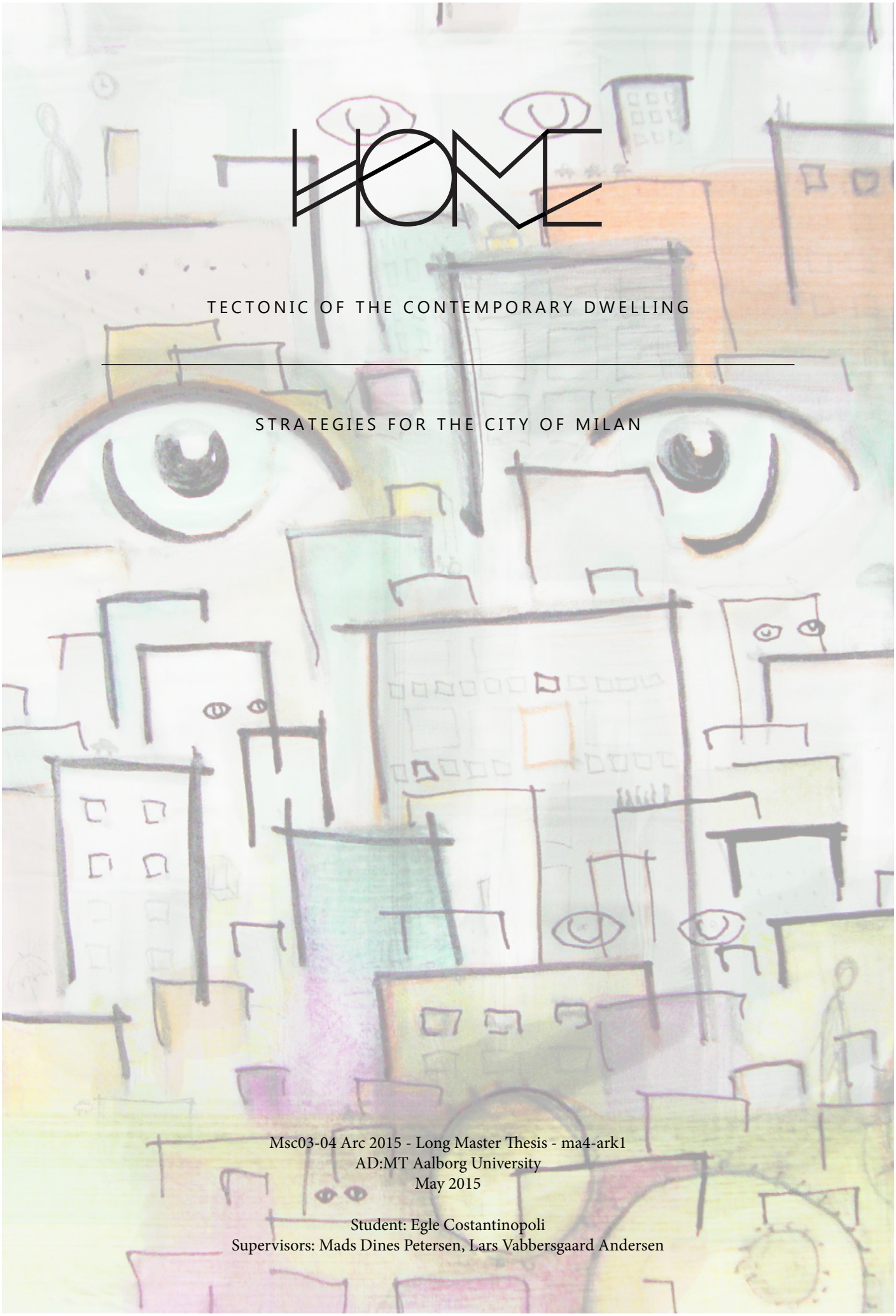

HOME

TECTONIC OF THE CONTEMPORARY DWELLING

STRATEGIES FOR THE CITY OF MILAN

Msc03-04 Arc 2015 - Long Master Thesis - ma4-ark1
AD:MT Aalborg University
May 2015

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ABSTRACT

This Master thesis focuses on the theme of dwelling in dense cities with the goal of giving citizens 'homes' instead of 'housings'.
The report approaches the question first of all with a theoretical research, and later with an application of its result on a design proposal for the area of Ronchetto S/N in Milan.
The theoretical research contributes to a contemporary definition of tectonic architecture oriented to the creation of places to live. The research uses as main methodology a bibliographic review, which summarizes the studies of architects and critics from the XIX to the XXI century on the themes of sensuousness, functionality, comfort, permanence, authenticity, and flexibility. The results of the review are then used to analyse selected case studies from architectures of the XX century with the aim to understand good practices for the approach of dwelling design in dense urban contexts.
In conclusion, the strategies and the theories learned are applied to the design of new dwellings in the city of Milan that aim to blur the boundaries between artificial and natural landscape and to give the inhabitants the feeling of belonging from the place in which they dwell, even called the feeling of being home.

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PREFACE

Living in Aalborg for almost two years now I discovered for the first time a different dimension of living. Born in Milan and living for some months in London, I was used to the frenetic rhythm of the dense city and I 'tasted' the slow-time of the low-density environment only in some weekend journeys in the countryside or in temporary permanences in Rwanda and Morocco. All of these experiences were too short to allow me to find a new rooted life-style, but they started in me the interest for a different living perspective. On the contrary, the small city of Aalborg had to become my home. I had to deal with the fact that stress (my loved stressful life-style) disappeared from my daily life. It is incredible how people get used and miss the most wrong details of their habits.
After this period in the peaceful Denmark, I started asking myself, as a future architect, how to improve the city-experience. How to make citizens discover that there's another way to live that doesn't necessary include stress, noise, rush, continuous unpredictable transformations, homologate and unrecognisable spaces, narrow rooms. But this life-style does not require to move to the suburbs in a choice 'in or out'.
If I am not able to change the city in its entire dimension, I will start from designing new homes. A dwelling is the smallest unit of space in which a person can find his 'place-to-live', and the apartment seems to be the natural housing typology for a city. **An apartment in the city can become home**.
I remember every first day in a new apartment. The first thing that I do entering the door of the empty room in which I will sleep and live is to personalize it. I put my objects and my posters, I reorganize the furniture creating comfortable areas. I need to find something that makes me recognize that generic space as 'my space'. I need to feel home.
Approaching the problem from the architectural point of view, thinking about filling the emptiness of the space with personal objects is not enough.
For this reason, with this Master thesis I investigate the theme of dwelling in the contemporary city.

My primary question is: **how to feel home in a city?**

The question on the home space-identity architecturally translates in: **how to design an apartment as a frame in which everyone (or each of us) can define his home?**

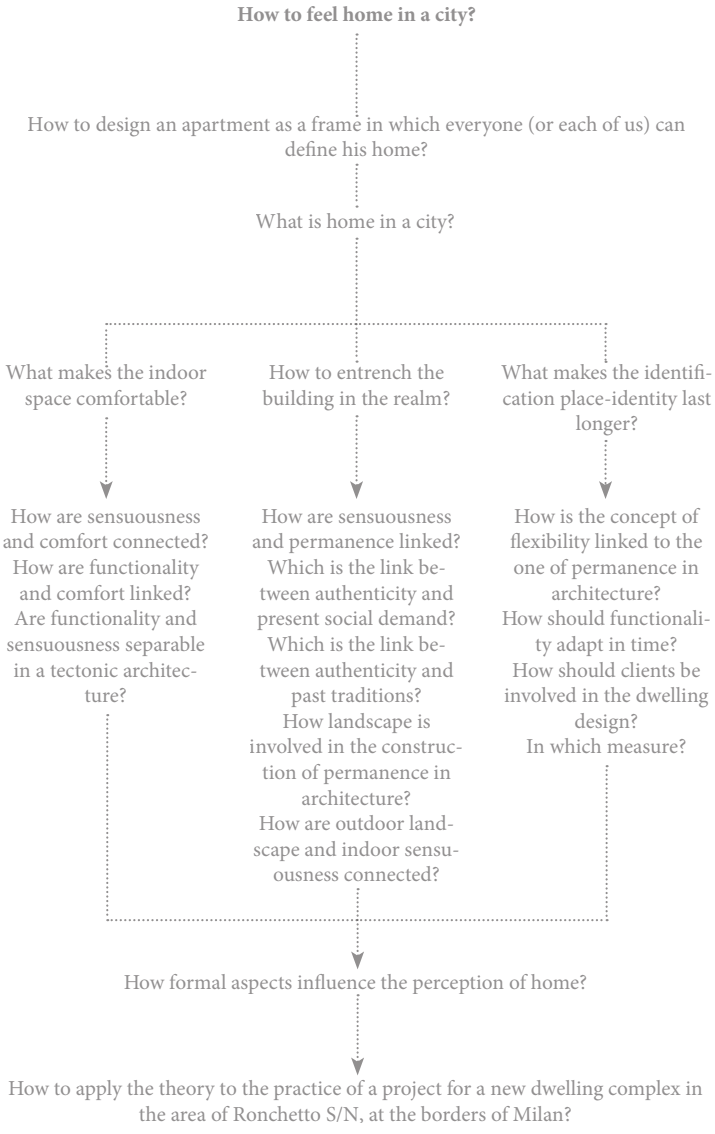


Diagram of the thesis research queries structure.

In order to answer to this apparently simple question, this thesis will present some new dwelling solutions for the city of Milan.
The choice of the project area belongs from both a personal interest, since Milan is my natal city, and from the fact that Milan hosts the International Exposition 2015, event that stimulated in the last years big transformations of the urban environment, including reflections on the theme of 'living'.
In particular for the area of Ronchetto Sul Naviglio the Municipality of Milan has a project of densification and integration between a park and new dwellings that I decided to take as opportunity to develop my personal design.
The project described in this report belongs from a theoretical research in architecture related to the theme of being home. Consequently, the report is organized in two main parts: *Part 1 - Learning from the past*, and *Part 2 - Designing for the future*.

Part 1

Part 1 collects the theories and approaches of several critics and architects on the theme of home and finds sub-questions to the issue.
The methodological choices of the present research belong from the consideration that "within architecture the quality of **a particular space cannot be defined using a general positive rule**" because "it is context-dependent, and in order to understand its qualities we have to perceive it; to sense its qualities as a phenomenon" (Hvejsel 2012). This statement, as underlined by Hvejsel, makes clear that **an approach to architectural research that considers technical aspects only risks to delete the understanding of the reciprocal relationship between architecture and contextual realm**. Just in the same way, **an approach purely sociological or aesthetic can lack on applicability in the reality of architectural practice**.
Clearly, technical aspects of the built space are describable and verifiable through numerical analysis, but sociological and aesthetic implications of architecture are not measurable in the same way. Acknowledging this, the problem of how to give a scientific and reliable approach to the present research occurred to me. In general, it is possible to divide scientific investigations into quantitative researches and qualitative ones (The four main approaches 2009). The first type belongs from a positivist approach and bases conclusions on a **deductive method**: general hypothesis are defined and have to be verified in particular cases. In this case the results of the research are considered objective and generally valid but "not suited to describe complex human and social issues". On the opposite a qualitative research mainly uses an **inductive approach**: general theories are drawn starting from the observation of specific cases with the aim to "gain a rich and complex understanding of people's experience".
Understanding architecture as a phenomenon, I decided to use an approach to the research mainly qualitative. A bibliographic review has been used to draw the general lines of the actual architectural debate concerning dwellings and the concept of home. The critics' hypothesis analysis has been consequently used to formulate a personal theory regarding the ways in which architectural details are involved in the mental construction of the home space. Finally, case studies verified the pertinence of the theory in the architectural practice. Nonetheless, **the personal theory developed in the first part of this report does not aim to build a manual on how to design an apartment in which citizens can feel home, but proposes a tactical approach to architecture oriented to the definition of home spaces.** This tactic will be verified in its practicability in the design phase (Part 2).

In the first part of the present report it is possible to find three chapters: *The contemporary problem* (marked in blue), *Trends, between past and future* (marked in yellow), and *Synthesis* (characterized by the colour pink).

The first chapter (pages 25-30) contains the **acknowledgment of the contemporary debate** concerning the theme of dwelling and formulate first problematical queries related to it in order to determine **what creates the feeling of home**. This chapter will investigate the meaning of dwelling today in comparison to the one of the past. Particular attention will be put into the social and technological aspects that are involved in the evolution of dwellings in cities in a tectonic perspective.

The Contemporary Problem

The second chapter represents the **main body of the theoretical research** and has the aim to answer the questions proposed in the previous one, collecting a series of indications from the past, organized by theme, that should influence the architecture of the future.
In order to do it, the thesis will firstly narrow down the focus of the research defining a specific **problem formulation** (see *Introduction* pages 33-34). Secondly, other three sub-chapters will deepen the understanding of **how the home place-identity is created**, but each time focusing on space **comfortability** (see *Sensuousness and Comfort* pages 35-57), **authenticity** (see *Permanence and Authenticity* pages 59-78), and **flexibility** (see *Functionality and Flexibility* pages 79-95). Since much knowledge of architecture is stored in buildings and design, each of the three sub-chapters is composed by a first section dedicated to a specific **bibliographic review**, and a second section that presents a relevant **case study** and tries design experiments on it.

Trends, Between Past and Future

At page 13 a diagram guides readers in the understanding of the logic that led the bibliographic review, summarised in the next paragraphs. In the diagram, the main links between the keywords of this research are shown and each term is associated to the main author selected in the present essay to study the issue. Nonetheless, the selected words have a different hierarchy: order in the page (from top to bottom) and capital letters emphasize those words that have a greater relevance.
Wanting to approach the wide theme of 'home', the philosophical approach of Maurizio Vitta (2008), Italian professor and architectural critic, is taken as starting point of this research in order to have a general understanding of the problem. Vitta reflects indeed on both **technical and psychological aspects of the living space**. Moreover, he underlines the **influence that the evolution of the architectural practice has on our culture** and life-style.
Acknowledging this, particular relevance in the present research is given to the concept of **place-identity**: the property of the space of representing our way of being and, in the same time, the possibility of people of identify themselves in the space they live. The scientific research on environmental behaviour of Ritu Bhatt (2013) is in this case taken as main reference. Bhatt is a theorist and critic based in the USA. She uses a multi-disciplinary approach oriented to deepen the understanding of the reciprocal influence between objects and subjects. Hence she completes and reinforces Vitta's research.
In my personal understanding, Vitta's reflections and the concept of place-identity underlines the presence of a **link between material and immaterial aspects of the space**. **Tectonic architecture** approach investigates this relationship and translates it in the architectural practice in the research of a way to **unify poetic and technical elements of buildings**. Naming the triad *Venustas-Firmitas-Utilitas* during the 1st century BC Vitruvius (in Alberti 1782) is the architect and civil engineer that constitutes the theoretical background of contemporary architects that aim to create tectonic architecture. He underlines indeed that architecture occurs when and only when aesthetic values, structural stability and spatial functionality are fused together creating an indivisible whole. His reflections are hence taken as starting point of the present essay and reinterpreted in a contemporary way in order to define a specific tectonic oriented to creation of dwelling spaces. The review of the Vitruvian triad is made by steps investigating point by point the authors' categories (page 33) and interrogating modern and contemporary critics that focused their researches specifically on that field.
The review of the concept of *Venustas* done in the present essay is reinforced by the study of Gottfried Semper (1989 & 2004). German architect and historicist, Semper built his understanding of **Aesthetic** interpreting the first of the Vitruvian categories and introducing with a historical approach the theme of perception of the space in the architectural debate. On the same line of thoughts, Juhani Pallasmaa (1994 & 2012), Finnish architect, does of **perception** of the space his personal focus in architecture, asking for multi-sensuality and **body involvement** in the space. Exactly to underline the necessity to involve all body and senses of users in the architectural experience, the present essay decides to use the word **Sensuousness** as translation of *Venustas* (page 33).
Pallasmaa bases his theories on personal considerations whereas the studies and reflections of Galen Cranz (in Bhatt 2013), professor at the University of California, give a scientific background to them. Cranz founds her critics on the **somatic research**, that indissolubly links culture, body, and mind. She underlines in a somatic perspective the necessity to re-think the space in order to adapt objects and dimensions with the use that our body will do with them, of course in line with our cultural background. The somatic approach of the author is therefore here interpreted as the key to understand the existing link between *Venustas* and *Utilitas* in a contemporary way. In the chapter *Sensuousness and Comfort* (page 44) it will be described how the **feeling of comfort** of users belongs from the union of the two.
Focusing more specifically on the category of *Utilitas*, it will be possible to read in the next chapters a revision of the studies of Karel Teige (2002). Great architectural critic, Teige reflects on **uses** stressing the accent on functionality to the extreme. His approach clearly belongs from the Modern Movement reflections and is the one of an analyst. Teige has a quantitative approach to research that tries to give universal and objective answers to the problems of dwelling spaces in cities. Nonetheless his reflections on functionality of the space are the base in his scripts and in the present essay to investigate how to create the sensuousness of the indoor space through the **definition of the architectural details** (pages 42-43) and the reduction of wastes in the use of the space (page 65).
Against cultural *tabula rasa*, but appreciating simplicity and functionality of the International Style, Critical Regionalism (theorized by Kenneth Frampton, 1983 &1995, architect and historian that largely contributed to the contemporary definition of tectonic architecture) and Nordic Architecture (studied by critics like Mari Hvattum, 2012, Norwegian professor of architectural history) ask for the **entrenchment of the buildings into the physical and cultural environment** in which they are placed in order to create durable architectures. Both the architectural movements are taken by the present thesis as fundamental in order to start a reflection on the contemporary meaning of *Firmitas*. Usually this concept is interpreted as the necessity of creating stable structures and in the case of tectonic architecture as the necessity to integrate structural considerations into the design process. Differently I propose to extend its meaning from structural stability to **architectural permanence**: the property of building of endure in time thanks to its structure but also due to its capacity to em-

body users culture and needs.
The property of the architecture of being entrenched in the realm is here called **Authenticity** and it is interpreted as the attribute of the space that occurs when the concepts of Sensuousness and Permanence are linked together (pages 70-71). Frampton and Hvattum considerations, reflecting on the theme of authenticity, give a new value to the landscape and especially Hvattum underlines the relevance of natural elements in the creation of the architectural sensuousness. Reinforcing this concept, Stephen Kaplan (1989;1992; 1995), American professor of psychology, investigates the theme of the relationship between artificial and natural **landscape** from the psychological point of view, underlining the positive effects of nature on mental fatigue. In this way, the theories of Framton and Hvattum gain a new scientific value because they are supported by physiological and psychological researches.
Under the theme of permanence and authenticity, William Fawcett (2011) and Tadao Ando (1991 & 2007) stress the importance of creating **empathetic architecture.** The first claims the necessity to build the space starting from the mathematical analysis of the possible use that inhabitants will do of them (pages 87-88); the second one concentrates on the importance of designing having in mind the client peculiarity (page 88). Similarly, Bernard Leupen (2006), whom approach is mainly historical, proposes to create **flexible architecture** that adapts in time according to users desires, focusing on the **time dimension of architecture**. Hence the proper flexibility provision is understood in the present essay as the strategy to link the concepts of Functionality and Permanence (page 89).
In conclusion the diagram at page 13 shows that the keywords of **Comfort, Flexibility, and Authenticity** have been linked in the present essay to the reading of the architectural results of three of the main modern architects, selected for the relevance of their focal points: Adolf Loos (Denti 2004; Frampton 1989; Colquhoun 2002), particularly concerned about the **quality of the indoor dwelling space**, Tadao Ando (1991 & 2007; Dal Co 1995), concentrated on the **relationship between indoor and outdoor space**, and Steven Holl (2012; Marquez &Richard 2003; Kronenburg 2007), that focused part of his research on **flexibility provision** in dwelling spaces.

Synthesis

The last chapter of Part 1 **summarizes the results** of this research **giving a personal definition of tectonic architecture** and **opens to possible future perspectives** (pages 97-103).
As stated before, the results of this section of the thesis don't want to give a universal answer to the problem of dwelling in cities. On the opposite, in line with Hvejsel indications (2012) they constitute the base for starting a 'testing phase' within a specific context: a new dwelling complex in Ronchetto Sul Naviglio.

Part 2

In the second part of this research I will hence take the wish of the Municipality of Milan to transform the area of Ronchetto Sul Naviglio as an opportunity to deepen the study of the tectonic contemporary dwelling and verify the theories developed in the first part of the report.
The context needs to increase its density including a park, residences, and commercial activities.
Following a similar logic of Part 1, Part 2 is divided in three main chapters: *The Site*, *Design Definition*, and *Design Presentation*.

The Site

The Site **collects the elements** useful to guide the future definition of the architecture. Therefore this chapter is devoted to **analyse the context** starting from the large scale of the city of Milan and gradually focusing on the specific area of Ronchetto Sul Naviglio. It will be possible to find in this chapter all informations related to cultural background of the city related to the theme of dwelling and families, geographical and climatic description, urban analysis of the area related to grids, functions, green spaces, and other natural elements. The analytical part finishes with a **personal interpretation of the site** characteristics that draws a **general vision** for the future design and a general urban concept.

Design Definition

The chapter named *Design Definition* is devoted to the **definition of a programmatic strategy** for the future design that belongs from the analysis and from the theoretical study of the first part of the present report. In this chapter is clarified **how the theory defined in the first part is related to the final project** and how the project will be used to verify this theory in the practice of architecture.

Design Presentation

Finally the chapter *Design Presentation* collects **drawings and specifics of the proposed project** for Ronchetto S/N. The project can be seen as a practical example of how the theory developed can be put in practice and underlines potentials and limitations of it.

Glossary and List of names

Besides theoretical research and project development, a Glossary and a List of names help the reader in the complete understanding of the study.
The Glossary gives a synthetic definition of the main world utilized in the text, already started in this chapter, making clear the position taken by this research on specific issues. The words have been selected according to their relevance in the report, in order to avoid misunderstandings by the readers. Hence in the glossary are collected both technical words and common-use terms that have been used

within a peculiar accent in this thesis.
The List of names briefly describes the research approach of each of the main authors already named in the previous lines and underlines the influence that they have on the present research. Similarly than in the Glossary, the authors have been selected between the ones studied according to their relevance in helping outlining the overall theory of this essay.
As a result, reading the two sections the report users will have a complete picture of the background of this research.

READING GUIDE

Before continuing with the development of the critical essay, some practical informations are here collected about the structure of this volume.
As stated above, this thesis consists in two main parts: *Part 1 - Learning from the past*, and *Part 2 - Designing for the future*. In spite of their mutual relation the theoretical part of the thesis can be read independently of the final design project, whereas it is built upon the theory developed.

With regards to the particular built up of this volume, each of the chapters composing the theoretical part, *The Contemporary Problem*, *Trends Between Past and Future*, and *Synthesis*, is recognizable thanks to the association of a colour to the section, that has a square in the extreme top right part of each spread to make it visible also when the book it's closed; namely: blue, yellow, and pink. The same sequence of colours is used also to distinguish the chapters composing the design part, *The Site*, *Design Definition*, and *Design Presentation*.
On the side of main text, keywords and diagrams guide the readers in an easier scan of the contents of the research and images, completed by captions, suggest interpretations to the treated issues.

The report is organized in such a way that the reader is guided through all the analytical processes before they are presented with the final results, presentation drawings and design process. Regarding plan drawings in the book, all North points face up the page unless otherwise stated.
Regarding images in the book, captions should be read from left to right in each spread.
All images are mine unless otherwise stated.
Reference to literature is done according to the Harvard method.

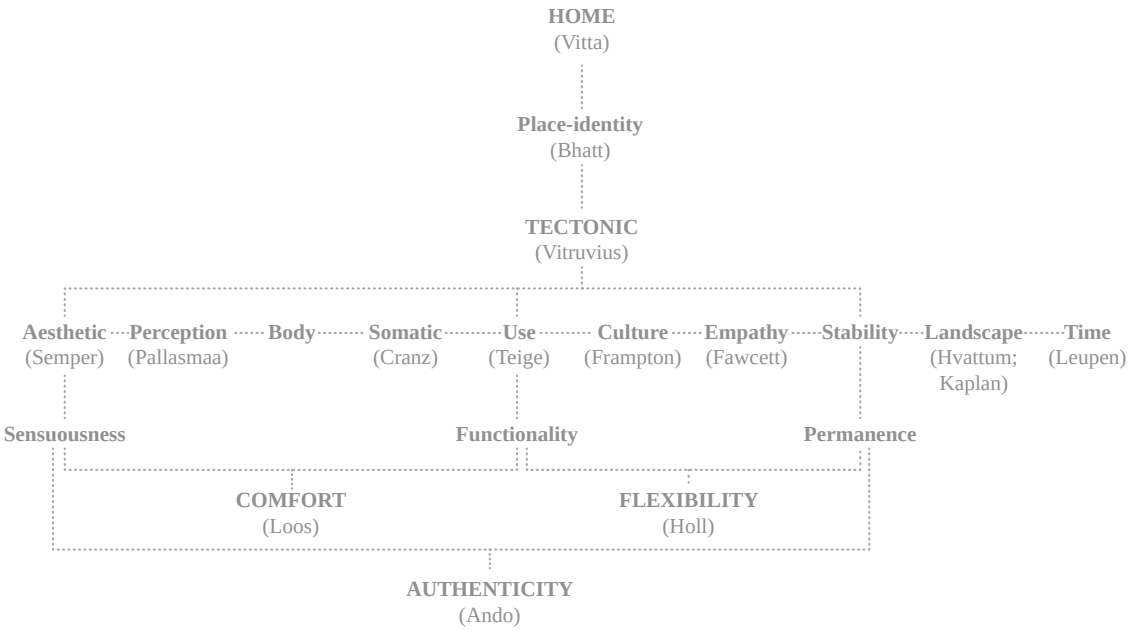


Diagram of the relationships between main authors and thematics.

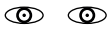
GLOSSARY

This section of the report has the aim to guide the readers in the understanding of the meaning of those terms that are used in the thesis development and that could have a double interpretation. Most of them are present in the diagram at page 13 because, as described in the Preface, they are the keywords guiding the present thesis. But to dwell, detail, gesture, and principle have been added. To dwell is indeed implicit in the word home and for this reason it is important to define it in a clear way. Detail, gesture and principle, on the other hand, are not terms specifically involved in the thesis construction, but are part of every design process that aims to be tectonic and in this sense fundamental. Each term is associated with a logo that underlines the interpretation given in this research.

The words here collected and defined are, in alphabetical order:

Aesthetic
Authenticity
Comfort
Detail
to Dwell
Empathy
Flexibility
Functionality
Gesture
Home
Landscape
Permanence
Place-identity
Principle
Sensuousness
Somatic
Tectonic

Aesthetic: commonly describes something related to a sense of beauty and finds its origins in the Greek word *aisthanesthai*, to perceive (Source: http://www.merriam-webster.com/dictionary/aesthetic). In this thesis, the term aesthetic is used, according to Semper's understanding (1989 and 2004), to indicate the formal and physical characteristics of a built object that are visually pleasurable to visitors, or in other words are perceived as beautiful.



Authenticity: is the condition of being authentic, genuine, or true. This research applies the term to architecture embracing Pallasmaa's understanding (1994), in which authenticity relates to the architectural quality of being rooted to the culture and to the space and consequently refers to the possibility of identifying ourselves in our individuality while living the space. In this way, the concept of authenticity and the one of place-identity are permanently linked. Critical regionalism (Frampton 1983) could be the architectural tool to obtain authenticity.

Comfort: literally is a synonymous of consolation. In architecture, it is often linked with concepts of indoor environment standards. In this report, it indicates the state of ease and satisfaction of bodily wants, which involve technical issues as noise, light, dimensions, etc. Nevertheless it is here investigated not from the quantitative point of view, but in its relationship with sensuousness and functionality. Comfort is indissolubly linked with the concept of psychological environment, since the mental construction of the space affects our behaviours and the link that we can build with a place (Day 2000). It is clear that a good psychological response to the built space encourage the creation of place-identity and consequently the feeling of being home.

Detail: Marco Frascari (1984) studies details defining them as generators of meaning in architecture and refering to Alberti (1782) while describing architecture as the art of the appropriate selection of details in the devising of the tale. Frascari writes: "the details in this way, while forming an indivisible whole, are individually perceived and understood". In his understanding, detail has not an unambiguous meaning in the architectural production, because it can indicate spacial cells as well as elements of composition, modules, and entire buildings inserted into a bigger urban composition. The problem of scale, in architecture, is indeed primary and can cause misunderstandings, but in all cases details indicate a joint; the joint can be material when it is the physical connection between two parts (as in the case of a capital that connects a column shaft and an architrave), or formal when it connects unbuilt elements (like in the example of porches that are the link between inside and outside spaces). This thesis adopts the author's definition of detail as the minimum unit of signification in architecture, in every scale. The concept of detail is linked with both the one of interior dressing (Semper 1989) and the one of scenery (Leupen 2006), which define the part of architecture that is possible to touch and see and therefore indicate the details that are involved in the construction of the space of comfort.

to **Dwell**: to remain, to stay in a place, to live it (Bhatt 2013). The word collects the whole range of activities and functions implicit in the experience of living a space; for this reason in the thesis the term dwelling doesn't simply indicate a house, a flat, an apartment or any other housing typology, but it implicitly refers to the ways of use of those spaces, the lifestyle, the habits, and the culture of their inhabitants.

Empathy: literally, indicates the power of understanding and imaginatively entering into another person's feelings or the attribution to an object, such as a work of art, of one's own emotional or intellectual feelings about it (source: http://www.wordreference.com/definition/empathy). This thesis applies the term empathy to architecture embracing Sekler (1965) understanding of it, that describes it firstly as the capability of architects to understand users' needs and wills; secondly as the capability of users of identifying themselves with the space. The first interpretation of the term is the base for Ando architecture (1991) or Fawcett (2011) methodology to quantify flexibility. In the second meaning of the term, empathy corresponds to the effect of place-identity.

Flexibility: in this thesis is related to the theme of momentariness of habits. Flexibility is the property of spaces to be alterable, extendible or polyvalent (Leupen 2006) in order to allow transformations in time according to needs changes. Nevertheless, flexibility doesn't have to be chased without considering the actual possibility of activity changes along the permanence in time of buildings (Fawcett 2011) and flexible spaces can be matched with a combination of differentiated spaces that host specific activities (Ando 2006). Since society is irregular and unpredictable, the proper provision of flexibility allows an extension in time of the identification inhabitant/place.

Functionality: is one of the properties that a tectonic architecture should have and is fundamental for the construction of the feeling of comfort. Teige (2002), Le Corbusier (2009) and Modern Movement in general consider it as starting point while approaching the design of space. The position of this study in relation to the theme of functionality is in line with Modernism in the sense that it accepts it as a fundamental part of a dwelling. Nevertheless, it does not want to level the architectural results in favour of extreme functionality, but mitigates Modernism teachings with the lessons of Nordic architects (Forster 2012 and Hvattum 2012), Frampton (1983), and Post-Modern architects, first and foremost Ando (1991 and 2007).

Gesture: literally indicates a movement or position of the hand, arm, body, head, or face that is expressive of an idea, opinion, emotion, etc. This thesis accepts the Marie Frier Hvejsel (2011) interpretation of gesture as the deeper concept of architecture and its primary intention. The gesture is the idea behind a piece of architecture, described by Anne Beim (2004) as 'ideal vision' or 'utopia'. It carries emotions, intentions and atmospheres that the designer wants to transmit through the space.

Home: common name for dwelling space that is physically, psychologically, and socially constructed in both real and ideal forms. It can be generally interpreted as the personal space of comfort. It is important to underline that the space of home is not grounded within locales, but includes the relationships between inhabitants and space (Latimer and Munro 2009). By consequence, any alteration of those relationships implies an alteration of the sense of place-identity that characterized the home space. Nevertheless, according with Lopez (2009), this thesis recognizes that dwelling and location are strictly linked and intermingled. In his understanding, the way in which objects are located in the space (gathered or separated, brought closer or moved far away) determines how we use the locales and how we conciliate our own way of dwelling with the built space. Loos Müller House case study will clarify the importance of disposition of the indoor locales, while Ando Rokko Hoising will show how the organization of outdoor spaces influence the indoor sensuousness.

Landscape: although is commonly interpreted as the sole natural component of territory, this thesis considers that a better understanding of landscape includes both natural and artificial details of territory. Agreeing to the interpretation of the Landscape Institute of the UK Government (2010), this research defines landscape as an area that results from both human actions (and interpretations) and natural factors. Architecture is part of the landscape and should build and transform it considering urban and natural as an undivisible whole. Hvattum (2012) insists on the fact that being rooted to the landscape does not mean that architecture has to mime natural shapes. It can also mean to reinterpret the landscape through the placement of ele-

ments that emphasize their presence and differences from nature, but encourage an active exploration of the space by visitors.

Permanence: is the property of architecture to resist in time. Belonging from the Vitruvian category of *Firmitas*, in this thesis Permanence includes considerations on both structural stability and durability of the building. Hence a permanent architecture considers the momentariness of social habits and organization and design flexible strategies to adapt in time (Fawcett 2011; Leupen 2006; Kronenburg 2007).

Place-identity: *genius loci*, spirit of place, sense of place. Named in different ways from many architects and critics, it describes the feeling of being part of a space, a house, a city, or a landscape and the feeling of belonging from it (Chris Abel in Bhatt 2013). This thesis considers fundamental the identification between people and space in the construction of the dwelling space. Having as a goal the creation of place-identity, comfort, authenticity, flexibility, permanence, functionality, and sensuousness might be part of the architecture that designs homes.

Principle: indicates the constructive and formal way in which the gesture is revealed in the final architecture (Hvejsel 2011).

Sensuousness: is the property of the space to involve visitors' senses until representing a certain interpretation of the world (Pallasmaa 1994). In this research, Sensuousness take the place of the Vitruvian category of *Venustas* in the architectural construction, usually translated with Aesthetic, because it more clearly recalls a total body involvement in the space. In This way, architects are pushed to consider in their design not only the visual expression of their results, but also their tactility and plasticity, their peacefulness and atmosphere (Pallasmaa 1994, 2012; Zumpthor 2006). Moreover, stimulating an active exploration of the sensuous space, architects can evoke synaesthetic experiences by users.

Somatic: analytic philosophy of the mind that has brought to the surface the correlations that exist between aesthetic cognition, the human body, and everyday life recognizing the identity body-mind-culture (Galen Cranz in Bhatt 2013). The knowledge of this discipline is relevant in this thesis to understand the ways in which visitors perceive the space when stimulated by physical characteristics of it.

Tectonic: literally describes the object of or relating to building or construction, from Late Latin *tectonicus*, from Greek *tektonikos* "pertaining to building", from *tekton* (genitive *tektonos*) "builder, carpenter, woodworker; master in any art (sculpture, metal-work, writing)", from PIE root **teks-* "to make" (see ***texture*** (n.)) (Online Ethimology Dictionary, http://www.etymonline.com/index.php?term=tectonic). The meaning of the world evolved in the architectural debate until defining tectonic a specific approach to architecture. In this thesis, starting from the Vitruvian definition of good architecture as the one that joints *venustas*, *utilitas*, and *firmitas* , a new triad is defined to describe tectonic: Sensuousness, Functionality, and Permanence have to create an indivisible whole that unifies symbolic and technical aspects of the built, in line with Semper (1989). As a completion of this definition, it is possible to quote Schmidt and Kirkegaard (2006), who write: "To use tectonics as the theoretical frame to talk about architecture is a way of balancing between two extremes: it rejects the thought of architecture as free art by pointing to how conditioned the architectural expression is (by aim, materials and techniques) and it rejects the thought of building as merely fulfilling a need by pointing to the cultural significance of architecture".

INDEX OF NAMES

This section gives an overview on the main authors studied in this thesis, selected for the relevance of their researches in relation with the themes here developed as shown at page 13 in the diagram and described in the Preface of the present report. Hvejsel is added to the list for the relevance of her studies in the construction of the research methodology of this volume and the case studies analysis.

The authors here described are, in alphabetical order by surname:

Ando, Tadao
Bhatt, Ritu
Cranz, Galen
Fawcett, William
Frampton, Kenneth
Holl, Steven
Hvattum, Mari
Hvejsel, Marie Frier
Kaplan, Stephen
Leupen, Bernard
Loos, Adolf
Pallasmaa, Juhani
Semper, Gottfried
Teige, Karel
Vitruvius, Marcus Pollio
Vitta, Maurizio

Ando, Tadao (1941-) is a Japanese self-taught architect whose approach to architecture and landscape, categorized as 'critical regionalism', is relevant in this research because it shows a methodology to integrate nature in contemporary high density buildings. He claims in fact for architectures that encourage inhabitants to experience nature and emphasize landscape beauty. Moreover, Japanese religion and style of life strongly influenced his architecture and design, in which empty spaces are emphasized to represent the beauty of simplicity and promote physical experiences. Materials, internal organization of the spaces, and construction are all used in his works to underline the architectural gesture and create a tectonic result. His work is described by the architect himself in the book *Tadao Ando I, Housing and Housing* (2007). From the book this thesis extracted the main characteristics of Ando's approach and selected the case study of Rokko Housing (1983-99), described in the chapter *Permanence and Authenticity* with a focus on the relationship built/realm of the design process.

Bhatt, Ritu (...) is a theorist and critic that started as Assistant Professor at the School of Architecture in the University of Minnesota. Her area of interest includes history and theory of modern architecture, environmental behavior research, cross-cultural criticism and the relation between philosophy and architecture. Bhatt theories have been studied through the reading of *Rethinking Aesthetic, the Role of the Body in Architecture* (2013), of which she is editor. The collection of papers inside the book, written by different critics from different fields, gave an overview of the contemporary debate upon the existing link between body and space, considered in this thesis as fundamental for the construction of the home space.

Fawcett, William (...) is professor at Cambridge University. His researches focus, since his PhD thesis *A mathematical approach to adaptability in buildings* (1978), on the necessity of a provision and quantification of architectural flexibility in order to extend the identification between inhabitants and built spaces in time. This report studies the author paper *Investing in flexibility: the life-cycle options Synthesis* (Fawcett 2011) with the aim of understanding a scientific method to verify the necessity of flexibility provision in dwelling environments.

Cranz, Galen (...) is professor of architecture at the University of California, Berkeley. She teaches courses in the social and cultural basis of architectural and urban design and research methods. Her research includes body conscious design and is relevant in this thesis for the indications that it gives about how details influence the inhabitants perception and use of space.

Frampton, Kenneth (1930-) is a British architect, critic, historian and the Ware Professor of Architecture at the Graduate School of Architecture, Planning, and Preservation at Columbia University, New York. Frampton is well known for his writing on twentieth-century architecture. His works include *Studies in Tectonic Culture: The poetic of construction in Nineteenth and Twentieth century architecture* (1995) and *Prospects for a Critical Regionalism* (1983) in which the author explains the necessity to revalue building structure in its expressive potential and local characteristics of the realm to entrench buildings in the context in which they are placed.

Holl, Steven (1947-) is an American architect and watercolorist. Holl's architecture has undergone a shift in emphasis, from his earlier concern with typology to his current concern with a phenomenological approach; that is, with a concern for man's existentialist, bodily engagement with his surroundings. The shift came about partly due to his interest in the writings of architect-theorist Juhani Pallasmaa. In this thesis, his Fukuoka Housing project has been analyzed for its focus on flexible living spaces that revisits in a contemporary way the traditional system of the Japanese Fusuma (Holl 2012; Marquez &Richard 2003; Kronenburg 2007).

Hvattum, Mari (1966-) is a Norwegian professor of architectural history and theory at Oslo School of Architecture and Design. She published internationally on 19th and 20th century architectural discourse and practice. In this thesis she has been considered fundamental to define the practice of Nordic architects, understand their strengths and clarify their methodology to contextualize buildings in the landscape.

Hvejsel, Marie **Frier** (1982-) is a Danish architect and professor at Aalborg University. Her PhD studies on the detail importance in the creation of the feeling of comfort and, in general, in the creation of the atmosphere of the space, published under the title *Interiority – A critical theory of domestic architecture* (2011), have been inspiring for this thesis.

Kaplan, Stephen (...) is a major theorist of environmental psychology and a professors of psychology at the University of Michigan. Stephen Kaplan and his wife are known for their research on the effect of nature on people's relationships and health. Their work on "restorative environments" and Attention Restoration Theory has impacted how landscape and design professionals and others view humanity's relationship with nature. The Kaplans have found that mental fatigue's remedy is found in exposure to nature. In order for nature to best work its relaxing effect it is preferable for a place to have a high fascination value, to be accessible, visible, and usable (Kaplan 1992; 1995). This report connects Kaplan understanding on nature effects on humans to Critical regionalism and Nordic design theories in order to find a new way to think contemporary housing architecture that links urban and natural environment in a whole.

Leupen, Bernard (...) is a Dutch architect, photografer and Theorist graduated at Technische Universiteit Delft in the seventies. He focuses his researches on the theme of dwelling and architecture of the city and he published in 2002 his PhD thesis *Frame and Generic Space*, fundamental in this research to deepen the theme of flexibility and understand it as a strategy to allow architecture to extend the permanence in time of the relationship place-identity thanks to the adaptation of locales functionality in time.

Loos, Adolf (1870-1933) was born in Brno in the Czech Republic but spend most of his life as an architect, writer and cultural critic in Vienna where he was among the first to spur the architectural development towards Modernism. Especially the publication of his *Ornament und Verbrechen* was resounded in the architectural world. The Müller House masterpiece is here analyzed to deepen the understanding of how detailing materials, locales dimensions and disposition in the space can create the sensuousness of the dwelling experience and consequently give inhabitants the feeling of comfort.

Pallasmaa, Juhani (1936-) is a Finnish architect, theorist and former Professor of architecture at the Helsinki University of Technology. With publications such as 'The Eyes of the Skin, of 1996 and the collection of essays entitled 'Encounters' of 2005 Pallasmaa has spurred a reintroduction of phenomenology into architectural theory agitating a multi-sensuous understanding of architectural space as an emotional field highly bound up with memory.

Semper, Gottfried (1803-1879) was a German architect, art critic, and professor of architecture, who wrote extensively about the origins of architecture, especially in his books *The Four Elements of Architecture* from 1851, and *Style in the Technical and Tectonic Arts; or Practical Aesthetics*, written between 1860 and 1863, to which several architects of XX century refer. These two essays are the starting point of this research in the understanding of how aesthetic is linked to the perception of comfort by people, approached in the chapter *Sensuousness and Comfort*.

Teige, Karel (1900-1951) was the major figure of the Czech avant-garde movement Devětsil (Butterbur) in the 1920s. Graphic artist, photographer, and typographer, he introduced modern art to Prague and brought international avant-guarde figures to lecture and perform in the city. Teige interpreted the work of Le Corbusier, Man Ray, Paul Klee, Vladimir Mayakovsky, and Walter Gropius for the Czech audience and, although not an architect, he was an articulate and knowledgeable architecture critic and an active participant in CIAM. Teige believed in a scientific, functionalist approach to architecture, as readable in the book *The Minimum Dwelling* (2002), and has been selected in this thesis for his relevant studies on social modern condition, which brought him to the definition of innovative design strategies to define an authentic modern-style flat.

Vitruvius, Marcus **Pollio** (c.80-15 BC) was a Roman author, architect, and civil engineer during the 1st century BC perhaps best known for his multi-volume work entitled *De Architectura*, a treatise written in Latin and Ancient Greek on architecture, dedicated to the emperor Augustus. It is famous for asserting in his book *De architectura* that a building must exhibit the three qualities of *firmitas, utilitas, venustas* in order to be considered good architecture. This text influenced deeply from the Early Renaissance onwards artists, thinkers, and architects, among them Leon Battista Alberti (1404–1472), who reformulated it in 1452 bringing Vitruvius architectural understanding toward the contemporary age. In this report, Vitruvian triad is the starting point for a reexamination of tectonic understanding in the contemporary debate.

Vitta, Maurizio (...) is an Italian professor at Politecnico di Milano at the School of Design. He graduated in Philosophy and he taught at Accademia di Brera and Naba, in Milan, but also at Isia, in Urbino. He wrote several books, articles, and essays on art, architecture, and literature, visual communication, and industrial design. His studies on the contemporary housing condition has been the starting point for a deeper understanding of problems and potentials of nowadays dwelling design.

PART 1

LEARNING FROM THE PAST

This Master thesis investigates the theme of dwelling in the contemporary city starting from the question: **how to design an apartment as a frame in which everyone (or each of us) can define his HOME?**

This section of the report contains a theoretical research, made through a bibliographic review and a related case studies collection on the theme of dwelling and sensuousness of the space.

The literature of the bibliographic review has been found starting from a research by keywords that followed the logic described in the *Preface* of this report.
Namely the keywords used, already defined in the Glossary and shown in their relations in the diagram at page 13, have been: aesthetic, authenticity, comfort, detail, to dwell, empathy, flexibility, functionality, home, landscape, permanence, place-identity, sensuousness, somatic, and tectonic.

In some cases, when the research landed in a key article or book of particular interest for this thesis, the bibliography of the author has been followed, as in the case of the article of Maurizio Vitta, useful to define the general features of the dwelling problem, and the PhD report of Marie Frier Hvejsel, inspiring about the relevance of details in the space construction, directly influenced by Frascari understanding of tectonics. Both the authors have an approach to the architectural research that integrates aesthetic, social, and technical aspects of the build space.

The case studies are selected between housing solutions that focus on: the interior spaces, in order to create the sense of comfort of the inhabitants (Loos' Müller House); mixed-density buildings that relates with the outside context, with the aim to link natural and artificial environment (Ando's Rokko housing); and on a high-density solution that provides users the possibility of changing the internal layout, in order to adapt to users' need in time (Holl's Fukuaka Housing).

The method of case studies analysis used in this report builds upon the method proposed by Marie Frier Hvejsel (Hvejsel 2011:83) that approaches architecture by scale. As indicated by Hvejsel, the aspects analysed are: **function**, to explain the functional qualities of the architectural gesture; **emotion**, to describe the emotional qualities

of the architecture; **realm**, to explain the contextual implications of the architecture; **construct**, to analyse the constructive techniques used; and **principle**, in which it is explained how the architectural gesture is revealed through a constructive principle.
Nevertheless this thesis implements this approach to fit the method with the specific research done. Each section of this research will describe the specific methodology used in the reading of the related case studies.

THE CONTEMPORARY PROBLEM

What is home in the city?

Dwelling is one of the primary functions of human beings and, as stated since 1753 by Laugier with the theory of the primordial hut expressed in *Essai sur l'Architecture*, it is the first reason of architecture as a shelter. This perspective, embraced by the biggest part of the architectural critics, makes us understanding that **dwelling implies to live the space, to stay in it and to feel comfortable**[1]. Moreover, the **growing request of habitations** around the world, thanks to the demographic growth, puts the theme of urban dwelling in a position of renovated importance because with all possibility the urban environment will exponentially extend (UN-HABITAT 2003).

Recognizing the implication of comfort of the term dwelling, it is possible to start the understanding of its double nature.
In the first place dwelling has a physical dimension that involves human beings in their corporeality. **The body** indeed **is the first measure of the space to live**. But dwelling is also cultural expression reached through a technological research that is meant to supply human lacks (Vitta 2008); it protects inhabitants from the outside creating an artificial environment subordinated to human needs and wishes. In other words, dwelling is the **materialization of an idea of living**; it is expression of the self-being. Commonly, we call the dwelling space that is **"physically, psychologically, and socially constructed in both real and ideal forms"** as **home** (Rowles and Chaudhury 2005).
The study on the identification of people with a specific environment, either natural or artificial, has been deeply approached by experts from several fields, from philosophy to psychology, architecture and urban planning, and it is recognized as a profoundly significant aspect of everyday life. For this reason many terms can be found in the literature to describe both the feeling of being home, such as "at-homeness", "placefullness" (Rowles and Chaudhury 2005), and the feelings that a place transmits to a person, with expression as "*genius loci*", "spirit of place" or "**place identity**" (Chris Abel, *The extended self, tacit knowing and place-identity*, in Bhatt 2013).
In particular, Vitta recognizes the reciprocal action between home as place-identity and individual persons. In his view, as stated before, **the home is the form of our being, but it also shapes our life through the definition of a particular way of living the space.** Basically, dwelling architecture represents and perpetuates a life-style. In other words, "a home offers continuity and familiarity, providing a stable framework for the creation of new realms of action" (Flade A., *Psychological considerations of Dwelling*, in Schwartz-Clauss 2002).
However, often in the contemporary city the value of intimacy and self-expression of the dwelling space is lost due to several reasons. Generally **the high density of buildings in urban environments reduces the amount of personal space available**[2],

1 In his essay *The extended self, tacit knowing and place-identity*, published in Bhatt R. 2013, Abel reflects among the nature of place-identity starting from the researches of philosophers and architects that approach the problem before him. He first refers to Heidegger reflection on the origin of the words building and dwelling, quoting: "What then, does *Bauen*, building, mean? The Old English and High German word for building, *buan*, means to dwell. This signifies, to remain, to stay in a place. […] The way in which you are and I am, the manner in which we humans are on the earth, is *Buan*, dwelling. To be a human being means to be on earth as a mortal. It means to dwell" (Heidegger 1971, *Poetry, Language, Thought*, New York, Harper Colophon Books).

2 The Economist compares the dwelling situation in the '70 with the one of nowadays writing: "In recent decades, by contrast, everyone has got a lot less space. We have had relatively little new building, but somehow we have magically created lots of new housing. Go almost anywhere in London–especially in the outer-suburbs–and this conundrum is quickly explained: houses every-

Home as place-identity

Fairburn E. 2014, *Map Portrait* on http://edfairburn.com/. The artist seems to visually represent the concept of place identity.

Elevation of a building in via Crivelli, Milan. The drawing capture the homologate and monotonous facade, in contrast with the concept of place-identity.

indoor and outdoor. As a consequence the feeling of comfort in the home space, intended in general as the state of ease and satisfaction of bodily wants, and the overall sense of place are reduced. Furthermore it doesn't seem to exist, in the contemporary architectural trend, a univocal dwelling typology or a specific architectural movement that answers to the actual social transformations.

Family and society

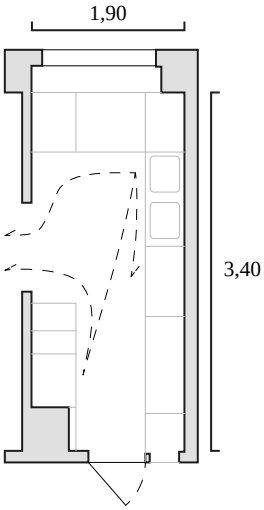
While in the past vernacular architecture represented problems and spontaneous solutions of a certain population in a specific context, today "the obsession for originality has eliminated the possibility of cumulative knowledge" (Pallasmaa 1994); consequently **the instability of society is reflected in buildings** (Corda 2010).

The XX century gave birth to Modern architecture in a similar background of social revolutions in which most of the European people moved from the country to the city exponentially increasing the urban spread (Zevi 2010). Consequently, the first necessity for urban planner and architects was, then as now, to organize and rationalize the urban habitat.

With this aim, **the typology of flats was theorized around the social structure of families**, determined as the nucleus parents + children (Vitta 2008, Teige 2002). The apartment reflects the typical habits of those families and, in line with the functional spirit of the time, it optimizes the spaces and makes them operational[1]. Nevertheless, nowadays **the family concept is changing** and so it is doing the society in general (Kronenburg 2007, Schwartz-Clauss & Vegesack 2002). Single parent families, couples and singles are more and more diffused in the multitude of familial situations. Moreover, the general life expectation is becoming longer, putting in a new perspective solutions for elderly people (Rowles & Chaudhury 2005).

Besides, inside the traditional formula parents + children changes are already remarkable: women, that used to be housewives, are generally employed out from the domestic space as much as men; youths and adults are often forced to frequently move city or country for working and studying reasons; difficulties and changes brought members of the same familial nucleus to live the different spaces of the house in autonomous ways (an example is the use of the bedroom by the teenagers, that often transform it in parallel and private homes spending in them most of the time); due to the accelerated rhythm of life, meals don't have anymore the sacral meaning of a family ceremony.

As Vitta noticed, the result of this situation is that **the image of the modern house doesn't find a validation into the contemporary family organization**. For this reason architects should update that image according to the different dwelling experiences.



Plan of *Die Frankfurter Küche*, designed by Margarete Schütte-Lihotzky (1926). The kitchen represents the essence of functionalism optimizing and reducing to the minimum the dimensions of the traditional kitchen according to the modern use of it by housewives. The plan shows the main internal paths of users.

Technology

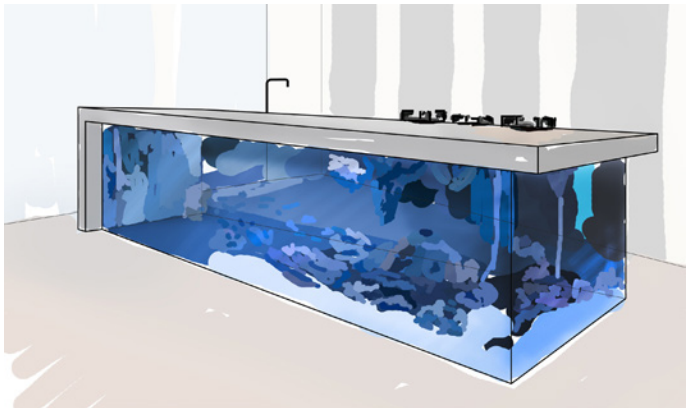
Social reasons are not the only involved into the transformation of the dwelling experience. Without doubt, **the technological evolution and the diffusion of digital appliances into the daily experience revolutionized our lives and with them the indoor space organization changed**. If usually the technological influence on architecture is investigated analysing changes in venting and heating systems and similar, it is also possible to notice other kinds of transformations.

An example of this is given by the switch of the salon from a

where have been turned into flats. A really remarkable part of the increase in the dwelling stock has come not from building but rather from breaking up existing homes into more dwellings. Essentially, so far, the housing crisis has been solved by subdividing our homes to make way for the extra population growth". (http://www.economist.com/blogs/blighty/2014/01/housing-space)

1 Further description on the Modern Movement, analysing good and bad consequences of the approach, will be given in the next chapters.

circular to a semi-circular organization after the diffusion of the television in XX century. Before the television, indeed the salon was meant to host guests and encourage conversations; consequently the shape of the space and the furniture supported the function creating a cozy and "democratic" environment. After the television, the intent of conversation of the salon disappeared. The space was transformed to allow the convergence of the view to a single point, similarly to the theatre organization, and involving changes on the social relationships, inside and outside the house dimension.
Continuing referencing to Vitta's analysis on contemporary dwellings, it is possible to underline how today the role of television in the house changed again and left the leadership to laptops, smartphones, touchpads and others. As a consequence, the salon returned to be the space of conviviality, **although the inhabitants are more and more enclosed in their own individuality**, unlinked with the other members of the family and continuously shifted in a virtual reality that is parallel to the physical space of the house.
The other two spaces that are massively involved in the technological renovation are, in Vitta study, bathroom and kitchen. **The introduction of microwaves, washing machines, dish-washers, whirlpool baths and other devices converted the logic of the spatial organization and modified the time of permanence in them**. For this reason architects are studying new solutions for the indoor spatial organization that consider those changes and rethink the whole dwelling experience.



Sketch of *Ocean Kitchen*, kitchen plan suspended on an aquarium by Robert Kolenik (2014). Society changes and technological developments transformed the role of the kitchen from functional to decorative.

The opinions collected above show that **the dwelling space is complex and its perception and use continuously change in time** following personal habits, social modifications and technological evolution. Moreover, the brief collection of critical studies emphasized the problem of the **absence of a contemporary answer to the dwelling demand** from the population that gives homes and not just apartments to citizens.
As stated in the preface of this research, the thesis starts its analysis to find an answer to a question that is apparently simple: **how to design an apartment as a frame in which everyone (or each of us) can define his home?** Which in this chapter, oriented to give an overview of the problem, became: **What is home in a city?**
Resuming the main points of the analysis above, we acknowledge that:

- Home is the form of our being, hence its definition is personal and subjective;
- The high density of buildings in urban environments reduces the amount of personal space available, indoor and outdoor;
- The homologation of building typologies in urban environments reduces the possibilities to identify ourselves with the dwelling space that we live;
- The typology of flats was theorized around the social structure of families, but the family structure and society in general are in continuous evolution;
- Inhabitants are more and more enclosed in their own individuality.

A good dwelling architecture in dense cities will consequently design the ground on which inhabitants could build their own individualities: **a space that is comfortable, sized on inhabitants needs and wills, rooted in the realm (physical and cultural) in which it is placed, and with the aim of extending in time the identification inhabitant-place at the maximum possible**.

From House to Home

From here: **What makes the indoor space comfortable? How to entrench the building in the realm? What makes the identification place-identity last longer?**
The general level of the queries underlines a necessity to do a step back in the analysis from the particular case of a dwelling design in dense cities, to a broader study on dwelling design in the contemporary context. Thus in the next pages these questions will look for an answer starting from the definition of what a good housing contemporary architecture should be.

TRENDS

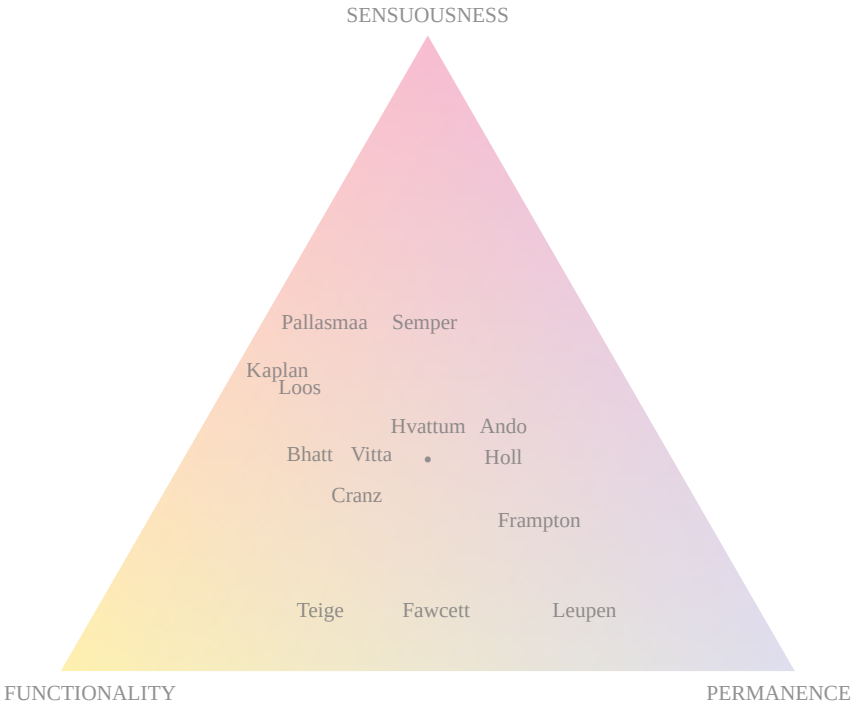
BETWEEN PAST AND FUTURE

Toward good architecture

In the previous chapter the social situation of dwelling has been clarified emphasizing the distance of the contemporary house from the past. Nevertheless it is important to underline the relevance of some researches on dwellings and to continue analysing solutions of some of the main architects from the XX century that could still be valid to solve new problems.
By all means indeed the issue of the definition of a good approach to dwelling design and more in general to architectural design is not only a contemporary issue. Already in 15 BC in *De architectura* Vitruvius looked for a definition of architecture in juxtaposition with the one of building, arriving to the conclusion that we can speak of architecture only when the built object respects the triad of *Venustas* (beauty, aesthetic expression), *Utilitas* (functionality) and *Firmitas* (stability)[1].
Since now, the definition of good architecture as the ensemble of aesthetic values, functionality and stability has not been surpass and **when the three parts work together in the design process as indivisible we can today speak about tectonic architecture**.

Defining tectonic

Surely approaching dwellings the **tectonic philosophy can be instrument of architecture to create the feeling of home** defined in the first chapter. However, the way to reach a tectonic result is not unique and in the years architects gave different weights to the parts that constitute the whole of architecture and different interpretations of the three Vitruvian components.
Utilitas, **Functionality**, clearly defines the necessity of buildings to answer needs and be useful, whereas *Venustas*, the aesthetic value of the architecture, risks to be reduced to visual formality (Pallasmaa 1994 & 2012). The present research proposes to translate *Venustas* with **Sensuousness**, word that recalls senses and sensuality, due to the assumption that the formal aspects of architecture should not satisfy vision alone, but **stimulate through formal choices a total body involvement** (further studies on the theme will be given in the chapter *Sensuousness and Comfort*).
A particular reflection might be done on the term of *Firmitas* as well. Usually intended as structural stability, this report proposes a new definition of it. Stability indeed can be meant not only as the capacity of architecture to stand thanks to a proper structure, but more in general as **the property of the building to endure in time**. In this case a better translation of *Firmitas* will be **Permanence**, which recalls both the structural stability and the durability that architecture might chase introducing more clearly the time dimension in the architectural debate.
Thus **this thesis defines tectonic the architecture that is sensuous, functional, and durable**.



The tectonic approach - Diagram of the author position inside the tectonic discussion. The triangle represents Vitruvius conception of architecture, in which the central point, equidistant from the vertexes, represent the position of the ideal tectonic architecture. Colours help to understand the weight of the three components of sensuousness, functionality, and permanence in each critic as it has been interpreted in this research.

1 The theories of Vitruvius were the base for the research of Leon Battista Alberti that in 1450 wrote *de re aedificatoria*. Thanks to Alberti, the humanistic culture of the time brought under a new light the theories of Vitruvio and sent them to us.

Building a methodology

In the next pages, the study of the theme of dwelling will go in first instance through the reading of critical essays related to tectonic architecture. The diagram above visualizes the position of the main authors selected in this study (already shown in their thematic relationships and relevance at page 11) in relation with the tectonic triad here described.
The investigation of the different approaches to tectonic has the aim to answer the questions named in the blue section of this report, that are here developed as follow:

1. **What makes the indoor space comfortable?** Under this question will be analysed the link between sensuousness, functionality, and comfort.
2. **How to entrench the building in the realm?** In order to answer, the relationship between sensuousness and permanence of the architectural result will be analysed, introducing the theme of architectural authenticity.
3. **What makes the identification place-identity last longer?** In this case, further studies on the link between permanence and functionality of the building will be given, introducing the concept of flexibility.

Objective 0

Clearly, all the queries are interrelated one to the other. Hence to each point will be dedicated a sub-chapter but it will not pretend to complete the survey on the theme. Differently each sub-chapter will have the goal to define a specific methodology for the analysis of a case study that focuses the attention on a peculiar aspect of the architecture.
Answering, it will be possible at a general level, in the pink section, to **reinforce the new tectonic definition** given above, and at a specific level, in the applicative design example of Part 2, it will create the necessary background for the **design of a tectonic residential complex** in the city of Milan.

Objective 1

Since the research is centred on the theme of home and feeling at home, it is logical to approach the theoretical study from the inside of the personal dwelling experience to the outside of the building layout. Therefore the first sub-chapter, *Sensuousness and Comfort*, will deepen the study of the details that create the sensuousness of the interior spacial configuration through the realization of a feeling of comfort (**dimensions, materials, disposition, light, and noise**) and will analyse Loos' Müller House. The chapter will analyse both formal and functional characteristics of the space.

Objective 2

Permanence and Authenticity will focus on the building scale studying the relationship between building and context (**Form, distribution, and outdoor organization**) in order to understand how sensuousness and authenticity are linked together, taking as an example Ando's Rokko Housing. In this chapter, the time dimension of the architecture is introduced, since authenticity requires, as it will be described later, not only a connection with the physical context in which the architecture is placed, but also a link with the history of the place and its culture. The case study is here meant to be a completion of Adolf Loos one, since it exceeds the indoor boundaries to bring the landscape scale into the dwelling debate.

Objective 3

Finally, *Functionality and Flexibility* will reflect on the permanence in time of the architecture, studying the way in which designers can deal with the time changes in both urban and architectural scale (**variability, multi-functionality, and extendibility**) in order to extend the life-time of the building not only caring about their structural stability, but also allowing functional adaptability that creates a new sensuousness of the home. In this case, Holl's Fukuaka Housing is the case study, which focuses again on the indoor spaces of the dwelling experience, but implements Loos' and Ando's theories through a clearer reflection on flexibility.
At the beginning of each sub-chapter a diagram shows, starting from the scheme presented at page 11, how the specific research of the section has been developed.

Problem formulation

At this point it is clear that the general questions defined in the blue section are here translated in practical design queries on **how formal aspects of a building influence its perception by users** and consequently the possibility of the definition of the dwelling as home. Consequently, the problem of the research part of this thesis is: **which are the formal parameters that influence the perception of home and how do they do it?**

1

SENSUOUSNESS AND COMFORT

What makes the indoor space comfortable?

As described in the chapter *The Contemporary Problem*, dwelling means to live the space, which implies to stay in it and to feel comfortable. In order to understand what makes us feeling comfortable, this chapter analyses the indications of different critics that treated the field. Starting from the definition of how vision influences final user perception of spatial sensuousness, this chapter will define the **relationship between physical spatial characteristics, functionality, and comfortability** of the space. Clearly, speaking about perception, the psychological involvement of users will be considered. Nevertheless, this report doesn't deepen the psychological aspects of the issue, leaving their understanding at an intuitive level, but develops the **study on the objective parameters (dimensions, materiality, and disposition) that architects can control in order to reach a specific gesture of the space: the sensuousness of the home space-identity**.

CHAPTER QUERIES

How are sensuousness and comfort connected?
How are functionality and comfort linked?
Are functionality and sensuousness separable in a tectonic architecture?

In the next page, a diagram synthetically visualizes the structure of the following chapter. The diagram builds upon the one presented at page 13 and associates to each keyword a logo that belongs from the Glossary. In this way it is a tool for readers to orient the understanding of the chapter contents anticipating them and showing the connections between themes.

Chapter structure

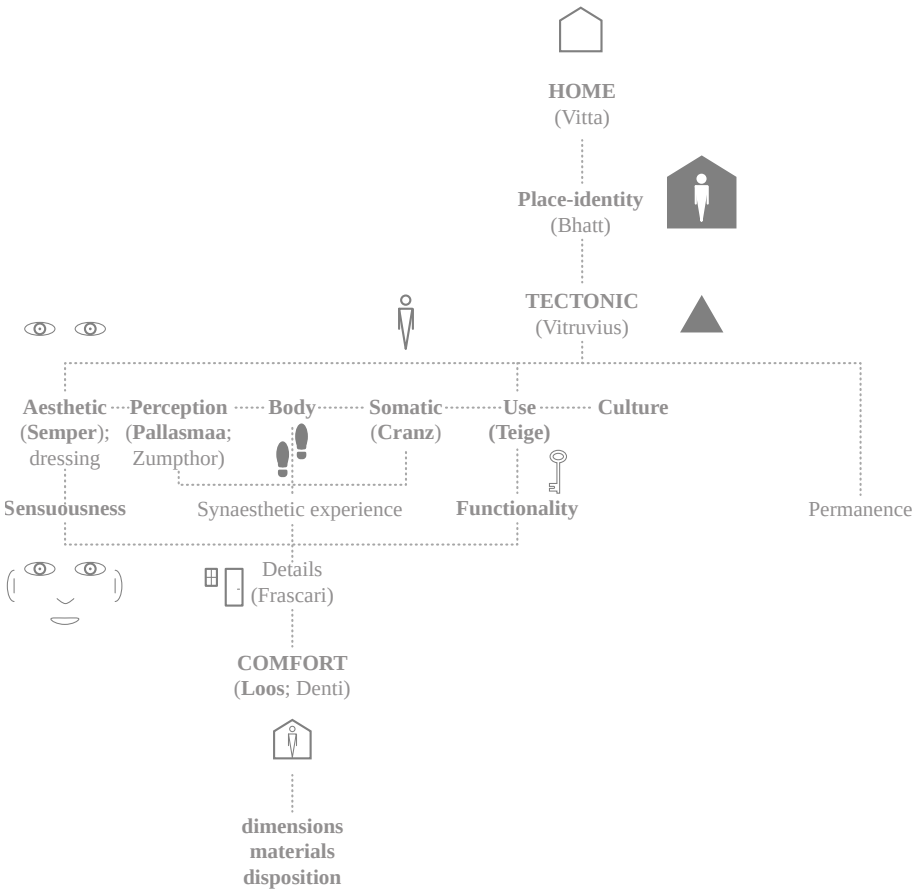


Diagram of the organization of the research related to the theme of sensuousness and comfort. In bold, key-words and main authors. Logos refer to the Glossary.

Having the aim of approaching the theme of sensuousness from the tectonic point of view, the first author analysed in this research is Gottfried Semper, considered by the most as the father of the contemporary tectonic theory. In the middle XIX century, Semper studied the way in which a space is constituted and perceived by its inhabitants. What he found and he trusted is that the aesthetic part of the built object is the most important in the users' perception (Semper 2004). **What we see helps us to build the first mental understanding of the space**, is what defines the feeling of cosiness or magnitude or even indifference. Scott Drake clearly explains the reasons of this phenomenon: "The dominance of vision might be explained by the way it is able to substitute for other senses. In particular, many of the functions of touch are performed in advance by vision. Having passed through that necessity phase of childhood where everything must be handled or placed in the mouth, we evaluate the tactile qualities of an object mostly by sight. Whenever we see an object, we instinctively anticipate its size and shape in relation to our body; its weight and texture, even its temperature. We evaluate cleanliness by sight, possibly aided by smell, as we look for patterns or dirt on the surface. Only when we see something particularly inviting are we inclined to reach out [...]. Vision also helps us to evaluate factors for which we have no dedicated sensory apparatus: we may have a sense of enclosure or privacy, of scale and orientation, of pattern and order. This substitution of vision indicates how the senses can interact, working together to build our awareness of the environment around us" (Drake 2014). Ornaments, decorations, and finishing have therefore a main role in the architectural construction and for this reason architects should be careful and conscious of their importance.

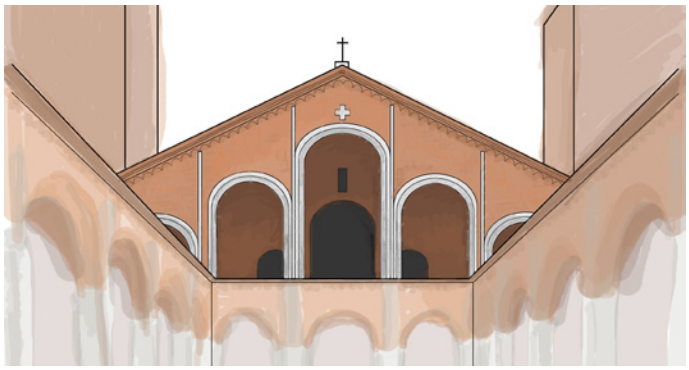
In *The Four Elements of Architecture* Semper (1989) writes: "The use of wicker-works for setting apart one's property, the use of mats and carpets for floor coverings and protection against heat and cold and for subdividing the spaces within a dwelling in most cases preceded by far the masonry wall, and particularly in areas favoured by climate. The masonry wall was an intrusion into the domain of the wall fitter by the mason's art, which had evolved from building terraces according to very different conditions of style".

And he continues: "Wick-work, the original space divider, retained the full importance of the earlier meaning, actually or ideally, when later the light mat walls were transformed into clay tile, bricks, or stone walls. Wickerwork was the essence of the wall. Hanging carpets remained the true walls, the visible boundaries of space. The often solid walls behind them were necessary for reasons that had nothing to do with the creation of space; they were needed for security, for support a load, for their permanence and so on" (Semper 1989).

Nevertheless, Semper considers **the supremacy of wick-works in the space construction switched in favour of walls hard-works thanks to the Romans' study on materials and constructive solutions**: "No longer were material and construction subordinate features hidden behind a partition wall, merely serving: they began to create form, or at least to influence it, a right the roof had already long enjoyed from the inception of the arts. Since the wall began to infringe upon the domain of the roof through the artistic use of the arch and the vault, even this ancient symbol of sacredness, the roof, has been robbed of its dominance and meaning or at least has had it disputed" (Semper 1989).

Once again, it appears in Semper's understanding that **the aesthetic expression of the constructive element is the key to un-**

The role of aesthetic

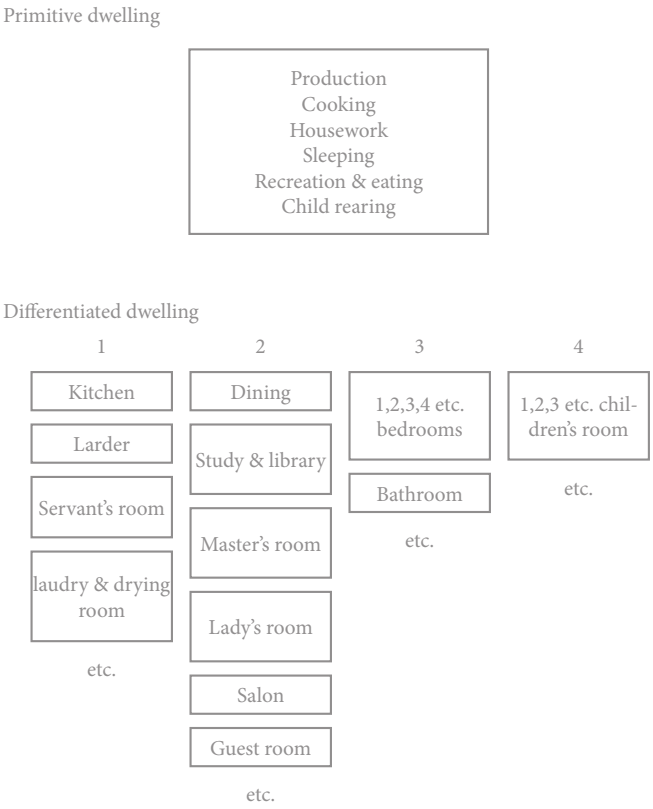


Aesthetic as expression of the constructive elements.
Perspective drawing of the facade of Sant'Ambrogio Church in Milan from the entrance courtyard (1129-1140). The facade shows how materials are used to underline the constructive elements of the composition: red bricks are used for the bearing walls, but a light grey stone is applied to the arches, enriching the openings detail and emphasizing their structural function, in line with Semper understanding of dressing and tectonic.

SEMPER'S INDICATIONS:

The aesthetic expression of the space guides us in the understanding of its gesture and use. In other words, a space is sensuous when its physical characteristics appear to us in line with our research for comfort and functionality. The interior dressing shouldn't hide the role of the particular constructive elements of the space (their function), but underline it through coherent choices on materials, colours, and finishing.

Details



Activities and space divisions.
Redrawing of the diagrams that Teige did in relation to the distribution on spaces and activities in dwellings, one for proletariat and one for middle and high class. (Teige 2002:15)

derstand the importance of the wall as spatial-constructor, that today can't be put into discussion. Since the wall became the origin of the space, what is represented on it, **the "interior dressing", should never hide its role**, but "the climate and even customs of a country must be considered in the selection of the colour key and the subject matter. The painting should be suited to and emphasize the character of the building in general and the purpose of its parts in particular. The peculiar static nature of constructive materials should be taken into account to emphasize their nature". With these indications, Semper encourages architects to include in their design choices regarding **materials, colours, and finishing details of the wall in order to protect the wall itself** from external agents **and to emphasize the gesture of the space**.

In brief, the Semperian understanding of aesthetic puts sensuousness in the first position for the construction of a place-identity; consequently the interior dressing has a practical meaning in the creation of the whole space, mental and physical. Bringing further Semper's research, Modernism moved the focus of the architectural research from aesthetic issues to technical questions, emphasizing structure and functionality as tools to organize and rationalize the urban habitat. The International Style **based indeed its architectures on the attentive analysis of the social realm of the time**, pretending to build a universal and scientific method to create good architectures. Its buildings are, in this way, authentic products of the Modern era.
The book *The minimum dwelling*, written by Karel Teige and published for the first time in 1951 in Prague, gives a perfect example of this attitude. The author considers the housing question a "problem of statistic and technology" and treats it consequently investigating social needs, energetic issues and wastes related to dwellings from the quantitative point of view: how much does the mass production satisfy the social need of dwelling? How much do we loose in energy to produce what we need? How much do we spend to own a land or a house?
Nevertheless, the quantitative questions posed are taken as starting point for an investigation that concerns quality and sensuousness in housing solutions. Teige, in fact, in line with the other exponents of **the International Style wants to promote functional dwellings that are optimized in their structural elements and minimized in size with the aim to guarantee adequate rooms to citizens and increase the quality level of urban life** of a period in which the city was dealing with a continue demand for space.
The research of Teige is related to the contemporary housing questions about primitive functions (intended as Teige defines them as basic and fundamental functionalities of a dwelling space) and implementation of them in accordance with new demands.
In Teige, the two opposite of the wide record of dwelling solutions are, from one side, the 'proletarian abode', and from the other the 'ruling class house'. The first represents the primitive dwelling, because it is composed by a unique room space in which a person can conduct all the living activities: production, cooking, housework, sleeping, recreation, eating, child rearing. Differently, the house of the ruling class, which he calls 'differentiated dwelling', is made by several rooms, strictly separated one from the others according to the specific function for which they are designed and organized in such a way to guarantee the privacy of the inhabitants (see diagrams on the side).
Nowadays we can read similar records of dwellings in which studio flats, generally occupied by students or youth, substituted the proletarian abode, and differentiated dwellings, mainly

thought for traditional families with children, staid unchanged. Teige's studies **understand limits and potentials of both cases and re-organize the dwelling schemes** in order to create architectures that:

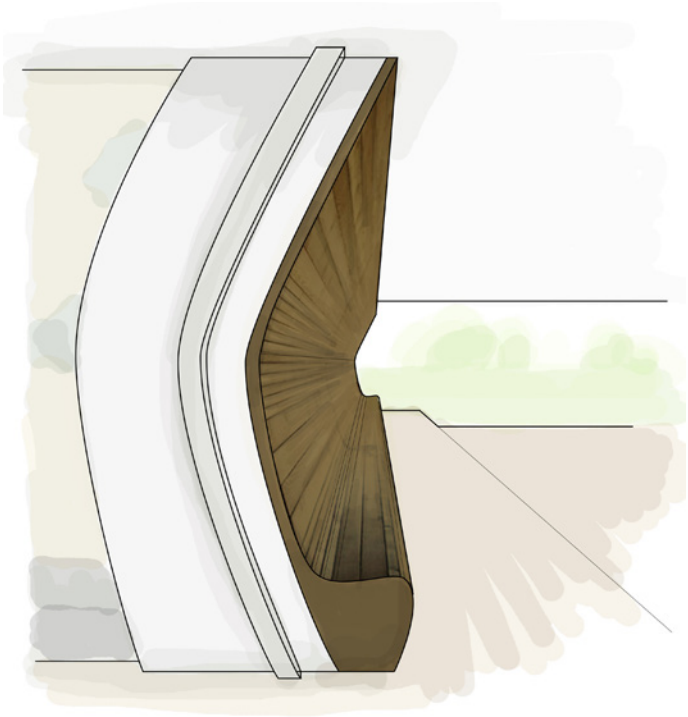
- **Guarantee a certain subdivision of functions** even in minimum-size apartment;
- **Revisit the hierarchy of functions and uses** of the bigger apartments to adapt them to the contemporary use of the dwelling space.

Besides the necessity that the author sees in minimizing sizes and distributional paths, is important to notice how Teige focuses on the architectural components of the dwelling, partly revealing the main focus of the research of Marco Frascari (1984). Frascari deepens the understanding of **details** defining them **as generators of meaning** in architecture and he refers to Alberti (1782) while describing architecture as the art of the appropriate selection of details in the devising of the tale. In the same way in fact Teige's details are the mean to tell a coherent and complete spatial tale.

The narrative details of the modern dwelling space that Teige pinpoints are:

- **Windows.** They have to provide the most reasonable relation between maximum glass area (allowed by the new construction systems post-and-beam and transverse bearing walls) and minimum cost (both for construction and housing management, guaranteeing minimal heat losses for heated rooms). They also have to do not take up too much usable space of the room or create an obstruction in the apartment. Finally, they have to provide a good illumination, uniform and diffused and create a better feeling of comfort (characteristics easily achieved through the use of horizontal windows).
- **Doors.** They have to be conformed to human dimensions and economized for the dimensions of the apartment (sliding doors could help in a better use of space).
- **Walls.** Freed from the bearing function, they can be light, movable, sliding, and folding. According to light requirements, orientation, and psychological effects on dwellers, walls can be colored to orient people in the space, predispose them to a certain mood, and enlarge space optically.
- **Furniture.** It has to be reduced in number of pieces and in its dimensions until defining a purely utilitarian furniture, based on standard dimensions. Furthermore Teige specifies: "**functional furniture is not an accessory but an organic part of a good functional apartment floor plan".** For this reason, **furniture should be coordinated with other dwelling installations as integral to the design of an apartment layout.**

In other words, these indications can be summarized saying that Teige encourages architects to have a tectonic approach to architecture, including functional, structural, and aesthetic considerations at all scales in the design process in order to obtain a result in which details and whole tell the same tale of optimization, comfort, modernity, and functionality.



Integration between architectural details - walls and furniture.
Perspective drawing of the VitraHaus cladding detail by Herzog and De Meuron, Vitra Campus Weil am Rhein, Germany, realization 2007-2009. The drawing shows the detail of the wall, studied to have a double function: it divides indoor and outdoor space and it hosts visitors becoming an organic seat. The detail can be read as the result of a tectonic approach to architecture in which structure, architectural components, and furniture elements are developed as a whole as asked by Frascari. Moreover in this way the architecture encourage the use of the outdoor space.

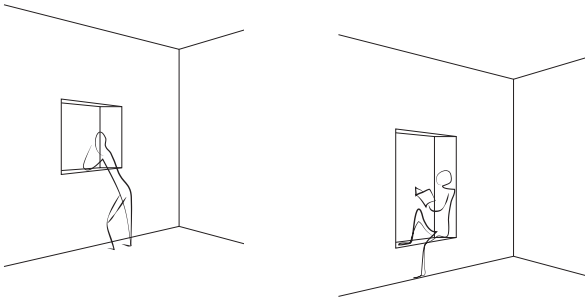
TEIGE'S INDICATIONS:

The dwelling space that wants to suit the modern life-style should aim for sensuousness and functionality, revisiting the traditional dwelling layouts in a contemporary way. Horizontal windows, reduced doors (ex: sliding doors), movable and coloured walls, and integrated furniture are the details that should be involved in the construction of the modern flat.

The relation body-design

Bhatt continues the debate on sensuousness and comfort in architecture relating it with the new interdisciplinary studies of experts from very different fields.

In the book *Rethinking aesthetics, the role of body in design* Bhatt (2013) collects essays from different authors to sustain his thesis about **the importance of aesthetic in human experiences**. In her view, **aesthetic has a "social, moral and cognitive role"** that architecture have to investigate in order to **rehabilitate itself from its position, that in some cases is the expression of pure**



Body as measure.
Interpretation of the indications of Cranz on how physical characteristics of the space influence the use by inhabitants. In the diagrams, the dimensions and position of the window encourage a different use of the frame.

functionality and in others is research of pure formality.
"Recent developments in neuroscience, phenomenology, somatic, and analytic philosophy of the mind have fundamentally reshaped the boundaries between these disciplines, and have brought to the surface the correlations that exist between aesthetic cognition, the human body, and everyday life" (Bhatt R. 2013). Through this sentence the author explains his will to rethink aesthetic in order to **reconnect body and design**, both physically and psychologically. He aims for a space that involves people and moves their mind.
The methodologies to reach this goal are described by the collection of critical papers of the book. Between the others, the voice of Galen Cranz emerges for its introduction of the theme of somatic through the essay *Somatic and aesthetics*. The author explains how the relatively new discipline of somatic (named in 1979 by Thomas Hanna) sustains that **aesthetic is perceived physiologically, emotionally and culturally**; meaning that "aesthetic is an experience that develops long before we learn to look at culturally recognized works of art". Thus aesthetic is partly instinctive and in this sense universal.
Cranz continues her analysis summarizing in points some design principles that could shape the space respecting the somatic theory at a furniture level:

- **Consider the relationship between head, neck and back while designing.** This consideration is in line with ergonomic scientific discipline theorized in the 1940s by Prof. Hugh Murrell (Ergonomics & human factors, n.d.). Whereas ergonomics aims at designing products that complement the strengths and abilities of people and minimise the effects of their limitations, rather than forcing them to adapt, Cranz principle gives a practical indication on how to do it. In her understanding designers should create furnitures and room spaces that sustain the back in the right position and allow bending movements through the use of knees and legs instead of a sole back inflexion. For example, taller chairs that create an open angle between legs and trunk delete the C-shape of the back while seated. Therefore formal choices will influence not only the aesthetic of the final object, but also its functionality.
- **Recognize that changes stimulate humans to consciousness**. Besides the force of habits and culture, shifts in material texture, temperature, scent and so on will stimulate the senses of users and will keep their attention on what it's happening. Hence changes encourage the perception of spatial sensuousness by users.
- Whereas we can recognize some common tendencies in the perception of what is comfortable[1], designers might **acknowledge that the feeling of comfort is highly subjective, mutable and subjected to habits.** The observation of common human habits in the use of objects can guide in the understanding of problems related to wrong designs and consequently improve them. In this sense the object functionality can modify the general users perception of comfort.
- **Recognize that objects carry intentions.** In this way, a designer might be able to send directions to users for a proper use of the space. Normative standards belonged from sci-

1 Users' tendency of considering comfortable similar environmental conditions is acknowledge and in some case used in order to calculate the level of comfortability of spaces. As an example, it is possible to notice that Thermal Comfort is described through the Predicted Mean Vote (PMV) and the Predicted Percentage of Dissatisfied (PPD). These two parameters describe namely the predicted sensation of cold or warm of users and the predicted percentage of occupants that will be dissatisfied by thermal conditions. The two parameters belong from the collection of data related to personal comfort sensations of many thousands of people within a thermal chamber (Human Thermal Comfort n.d.).

entific studies on efficient movements should be followed. Once again, formal choices, human configuration, and functional considerations might work together.

- **Accept pausing as a design method**. This "inhibition of the action" will allow designers to observe the process carefully and understand problems.
- **Create projects shaped by the social.** This means to approach the design process understanding first the activities that take place in the space and the life of the inhabitants, and then starting the actual design. Defining users and uses is the first objective of designers.

As it is clear, these principles can guide the contemporary design process, not only at the furniture scale, but also in the creation of the architectural space. Somatic considerations indeed could allow architects to create spaces that respect our "nature", intended as the ensemble of physical, psychological and cultural components. In this way, **the architecture becomes the space of personal comfort, which is not only beautiful and functional, but accommodates and stimulates a certain spatial experience and is shaped around the human body**.

CRANZ'S INDICATIONS:

Sensuousness is perceived somatically through physical, emotional, and cultural mediations. Hence the comfort of the space is perceived bodily and psychologically. If we can't totally control psychological responses to stimulus because they are personal and subjective, designers might preview usual responses through social studies. Moreover, they should acknowledge that objects carry intentions and changes involve users mind.

Synaesthesia, experiencing the world

The reflections of Cranz on the unity constituted by body-mind-culture can be seen as a completion of Juhani Pallasmaa's studies about architectural expression.

As Crantz aims to a somatic experience of the space, Pallasmaa encourages architects to respect human nature while designing, but his analysis, in line with the thesis of this report, focuses on the understanding that **people perceive and experience the world through the use of all senses**.

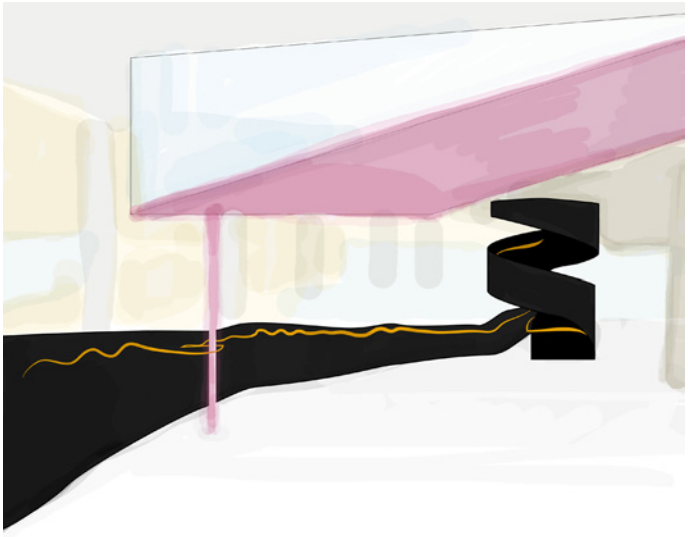
In his book *The eyes of the skin: Architecture and the senses* (Pallasmaa 1996) the architect presents his personal considerations about the increasing tendency of putting vision in predominance to the other senses in architecture, that brought to the elimination of sensory and sensual qualities from it.

His thesis is supported between the others by Marta Dieschinger. Dieschinger that dedicates her PhD thesis *Designing for All Senses* (2000) to the development of design actions to improve the accessibility in public spaces of visually impaired persons. Clearly, in her study the reflection on the importance of vision role in perception and design development is fundamental. For this reason she gives an overview on the scientific background constituting the base of our understanding of sensual perception of the space. She concludes that the acceptance of the simplistic theory of specialised organs as conductors of one kind of stimuli induces mistaken assumptions of the perception of space and of spatial qualities. Therefore, referring to Gibson's theory of perceptual systems[2], she encourages designers to have a brother understanding of our way to perceive the world in a synaesthetic way collecting informations rather than sensations.

Similarly, Pallasmaa's book strongly underlines the importance of "tactile senses for our experience and understanding of the world"[3] and invites architects to think **spaces able to involve all our senses simultaneously.** In fact, he is convinced that "the essential mental task of buildings is accommodation and integration. [...] Architecture does not make us inhabit worlds of mere fabrication and fantasy; it articulates the experience of our be-

2 Gibson, James (1904-1979), was an American psychologist specialized in visual perception. Marta Dieschinger refers in her PhD thesis to his book, *The Senses Considered as Perceptual Systems* (1966). The present essay does not aim to resume Gibsian theory, but focuses on the elements that are considered important in order to build an architectural theory on tectonic design for dwelling spaces.

3 To sustain his idea and explain the concept Pallasmaa quotes Jorge Luis Borges, which wrote the clever words: "The taste of the apple lies in the contact of the fruit with the palate, not in the fruit itself". (Jorge Luis Borges, *Selected Poems 1923-67*, London, Penguin as quoted in Pallasmaa 2012)



The space that involve all senses.
Personal interpretation of Trinity Laban Conservatoire of Music and Dance entrance hall, by Herzog and De Meuron. The building is designed to represent and encourage movement and agility, and the wood railing, softly moved by waves, underlines this gesture remembering dance. The body involvement aimed by Pallasmaa is complete in the detail: the bright colour of wood against the black wall catch the eyes, the smoothness of the treated wood tempts the touch, the waves that shake the railing make you want to dance while walking with the hands on it.

ing-in-the-world and strengthens our sense of reality and self. [...] Instead of creating mere objects of visual seduction, architecture relates, mediates and projects meanings. [...]**An architectural work is not experienced as a series of isolated retinal pictures, but in its full and integrated material, embodied and spiritual essence**" (Pallasmaa 1996).

Giving a scientific background to Pallasmaa's considerations, Frampton (1995) remarks how in history several critics understood the "capacity of the being to experience the environment bodily" and to reconstitute the world through a "tactile appropriation of reality". In Frampton's world our concept of space belongs from the body progression through space in depth. He also recognises that the contemporary architectural theories often result in the practice into buildings that exclude embodied experience because of the "philosophical alienation of the body from the mind". Quoting Scott Gartner, Frampton highlights that experience is reduced in these buildings to a function of the eye, whereas the body is reduced to an aggregate of needs and constraints but does not participate to the constitution and realization of architectural meaning.

Condemning architecture as pure form that focuses on advertising the space through the instant persuasion of a nice image, Pallasmaa reflects on the inherent meaning of architecture. In line with Vitta's opinion (2008), already presented in the first section of this research, Pallasmaa thinks that architecture is an expression of our current vision of the world, but at the same time it shapes the future vision of being in the world. In his understanding a return to a diffused use of natural materials, tactile and mutable in time, will create **durable architectures made of "hapticity, textures, weight, density of space and materialized light**". To defend this kind of architecture, Pallasmaa (1994) encourages designers to look for six characteristics: **slowness, plasticity, sensuousness, authenticity, idealisation, and silence**.

Slowness recalls human need of time to understand the reality in which it lives, while plasticity refers to the tactility of spaces, details, and objects that are thought and shaped for the human body. In line with Cranz's indications, **Pallasmaa aims indeed to an architecture that considers the human scale in its physical and psychological dimensions in order to allow visitors to experience reality in its complexity**, understand it, and just after activate eventual changes. The "full bodily participation" aimed by Pallasmaa doesn't exclude, of course, the engagement of vision in the perception of the space. Under the word of sensuousness in fact the architect underlines, as Semper before him, the role of vision in our mental construction of the space and brings the concept further claiming that **architecture has the potential to unify inner and outer realities providing a "stable and reliable ground for the perception of the world"**. Instead of creating sterile "aesthetic visual experiences", architects should represent "embodied images of authentic life".

Peter Zumpthor (2006) in his *Atmospheres* writes: "So, what moves me? Everything. The things themselves, the people, the air, noises, sound, colours, material presences, textures, forms too - forms I can appreciate. Forms I can try to decipher. Forms I found beautiful. What else moved me? My mood, my feelings, the sense of expectation that filled me while I was sitting there. Which brings that famous Platonic sentence to mind: 'Beauty is in the eye of the beholder'. Meaning: it is all in me. But then I perform an experiment: I take away the square - and my feelings are not the same. [...] I could never have had those feelings without the atmosphere of the square". Hence Zumpthor intuitively determines how the sensuousness of the space, that he calls atmosphere, is not made only by formal aspects, as it is not only dependent from the personal disposition to them. Whereas spa-

tial sensuousness depends on the mutual relationship between these two components. **The sensuousness of the space changes modifying formal choices as well as modifying users.**
At this point Pallasmaa's category of authenticity becomes fundamental, since it relates to the **architectural quality of being rooted to the culture** and consequently to **the possibility of identifying ourselves in our individuality while living the space**. Clearly, in order to create the authentic architectures here described, defining users is primary in the design process for Pallasmaa as it was for Cranz.
The last two themes, idealisation and silence, strengthen the concepts explained before, the first **asking for an architectural engagement in the construction of an ideal view of life**, and the second claiming the creation of spaces and architectures that lead us to a better understanding of ourselves through the protection of silence, the **absence of noise that encourage us to a self-exploration**.
We can easily see that in Pallasmaa the creation of sensuous architectures is a tool to give a shape to users place-identity as space of psychological and physical comfort.

In the end, Semper, Teige, Cranz, and Pallasmaa, even when they do not directly speak about homes, build their architectural theories explaining how users perceive the space and possibly identify themselves with it when architecture is the space of comfort. Hence in my understanding of their researches, a primary focus to reach an architectural result that is perceived as comfortable has to be the relation user/space. In particular, Semper focuses on the visual aspects on the space underlining that **materials (in their colours and textures), laying techniques, and finishing can enrich the indoor space and induce users to feel comfortable**. Teige deepens the study on the singular architectural details defining that **each spatial component has to play a role in the construction of the dwelling experience** in order to reduce waste and create comfort. Cranz specifies that the feeling of **comfort is subjected to cultural and social aspects**, but also that **the space is investigated by users through the interaction with it**. In this way, she reinforces Semper understanding that spatial details are primary because they suggest the intention of the locales, hosting specific activities. Moreover, speaking about the furniture scale, she emphasizes that details stimulate certain movements and poses. Tectonic design has to aim to a people involvement in the space, meaning that architecture has to encourage people to use and interact with the spatial elements, to move in the space. This reflection in this thesis has been interpreted as a necessity, at the architectural scale, to focus on **dimensional and dispositional strategies**. Finally, Pallasmaa introduces more clearly in the architectural debate the **necessity to treat the space involving not only vision, but also the other senses**: touch, hear, and smell are fundamental instruments of the users perception and collection of spatial informations, thus they might be part of architectural considerations. In this way, not only the colours of the materials are investigated, but for example also their softness, and their capability to **reflect or absorb sound**.
Summarizing, it is possible to define a theoretical methodology to create tectonic architectures, that doesn't have to be read as scientific approach universally valid, but can orientate to a conscious and integrated design.
The diagram in the next page visualizes the relation between physical reality and personal perception of people and it outlines the process aimed in this thesis from a tectonic design.

PALLASMAA'S INDICATIONS:

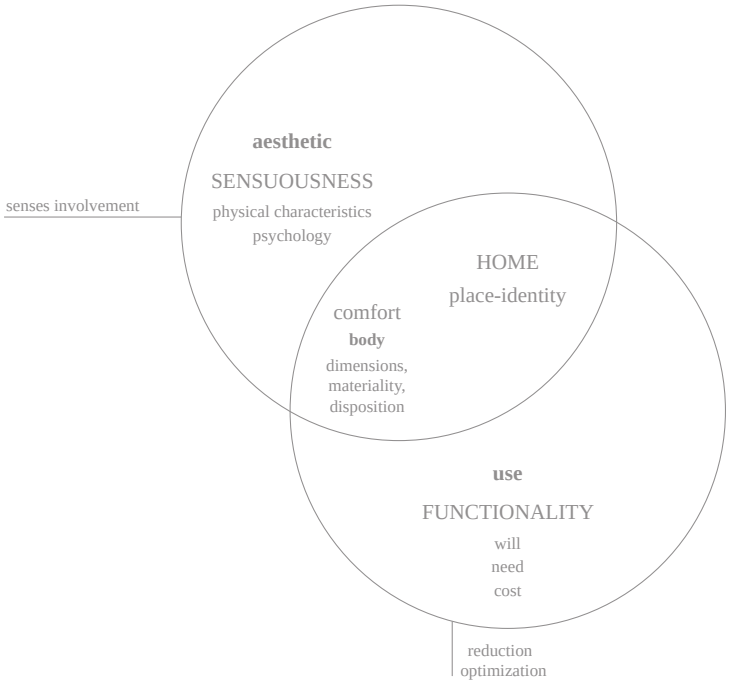
Humans perceive reality through the use of all senses, for this reason architects should design spaces that involve users with all their body engaging their minds through changes (disposition, compression and expansion of the space, materiality). The feeling of home is reached when materials, dimensions, lightness and noise level of the space fit with our needs of peacefulness and cosiness (according to the previewed use of the locales).

The relation user/space

Diagram of design process, reality components, and perception process.

What makes the indoor space comfortable?

Defining Sensuousness as the property of the space of stimulating users senses through formal choices and functionality as the property of the locales of allowing certain uses and activities through a proper provision of space and facilities, **it is possible to say that the feeling of comfort is reached by inhabitants of a place that is both sensuous and functional**. **This space indeed will satisfy users wills and needs** (see diagram below). Despite this in the next chapter will be underlined how the pleasure to live in a space is also linked to other factors, one for all the view toward outside (see chapter 2, *Permanence and Authenticity*).



The informations collected above have been used to define an analytic methodology that implements Marie Frier Hvejsel one (2012) and studies architectural projects focusing on the ways in which they solve issues related to the relation between users and space and consequently related to comfort.
As indicated by Hvejsel, the architectural aspects analysed are: **function**, to explain the functional qualities of the architectural gesture; **emotion**, to describe the emotional qualities of the architecture; **realm**, to explain the contextual implications of the architecture; **construct**, to analyse the constructive techniques used; and **principle**, in which it is explained how the architectural gesture is revealed through a constructive principle.
Considering that adaptability and flexibility of the building according to time changes will be specifically studied in the last chapter, and so temporarily neglecting Teige indications about the movability of walls, my personal interpretation of the bibliographic review of this section brought me to the conclusion that **the principles that allow architects to create the indoor space of comfort are**:

- **Dimensions** (compression and expansion of the space in plan and section);
- **Materiality** (colour, texture, smell, laying, finishing, reflectivity, and absorbency);
- **Disposition** (movement of the volumes in plan and section).

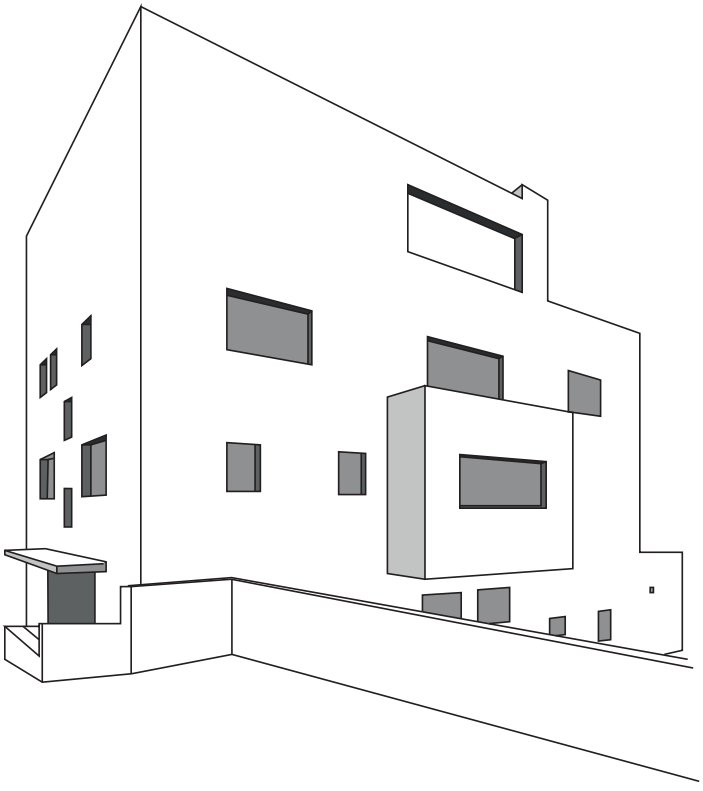
Investigating this principles, both the kinetic of the body in the space and the psychological implications of spatial configurations are included into the space analysis.

Each of the parameters above could be the starting point of a specific research. Nonetheless, this thesis doesn't have the space for such a study, but it will deepen the understanding on how they interact each others and how the ensemble of them creates the comfort space. In order to do this, a case study that follows the scheme of analysis described above is presented. Diagrams are used in order to visualise its characteristics as they have been interpreted.

One of the architects that in the history of architecture was more concerned about interior sensuality is Adolf Loos, that in Müller house signed his masterpiece.
The building consists in a detached house, for this reason might be considered not coherent with the research aim to develop strategies for dwellings in dense urban environments. Nevertheless, in this case the analysis will concentrate on the indoor environment of the house studying in particular the ways in which Loos intensifies it through the composition of different spaces with different characters. Moreover, these reflections are not related to the site in his works, which are indeed introverted. Having this in mind, his study could guide the design process of buildings in every context. The analysis will be done in the first place at the building scale to briefly summarize the characteristics of the object, and will later focus on the detail of the living area in order to deepen the description of the principles used. Some experiments will be done in order to understand how modifications in the parts (the details) that compose the space could influence the overall perception of it.

LOOS' ANSWER

Case study: Adolf Loos, Müller House (1928-30)



How formal aspects influence the perception of home as space of comfort?

Function

The house is a **detached house for the Müller's family**. As in the tradition of the dwelling for the high class of the XX century, the house presents different spaces differentiated by the function: at the ground floor, garage, cellar, and other technical spaces; from the main entrance level the living spaces start to develop presenting in sequence main living room, lounge, boudoir, library, dining room and kitchen; at the upper floors, family and guests bedrooms; on the roof, summer dining room and terrace.

Emotion

While solving the problem of dwelling, Loos treats the whole as a **continuous flux of singular spaces**, combined in plan and section in order to create a fluent and coherent narrative. The locales are defined to reflect the inhabitants way of life, host it and protect it from external invasions through a 'speechless' external cladding that reveals the inside organization just through the disposition of the window openings (Denti 2004). The indoor architecture that results from Loos approach is **dense of life**. It represents perfectly the style of the class for which it is designed, its richness, and its research for both **exhibition and privacy**. The locales are comfortable because they respects their purpose building around the inhabitants figures creating a series of **cosy places** linked, visually and physically, with the central area of the main living room, thought as the **public gathering room**.

Realm

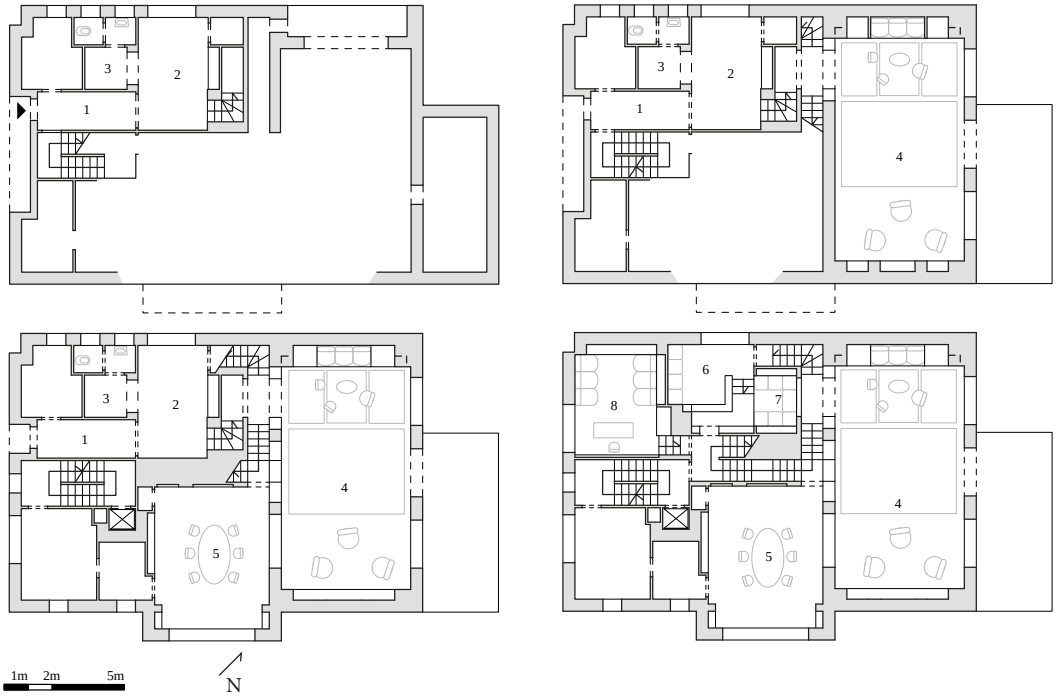
The house is in this way related to the life-style of the high class of the beginning of the XX century and respects its rules and expectations. Nevertheless Loos p**ass over the tradition while applying his own theory of the Raumplan** (the development if the plan in three dimensions) to the design project.

Construct

The structure of the building in Loos understanding is not fundamental in the spatial constitution, if not as a tool to build up the architecture. In this sense, we could say that Loos is far from Semper (1989; 2004) and Teige (2002) conception of tectonics, in which structural materials and the laying of components is part of the architectural expression. Nevertheless, **the traditional bearing walls that envelope the spaces and are carved in order to host furniture, become steps, or seats, or indoor windows** are fundamental in the creation of the architecture as a whole and the space as a continuum. Hence Loos architecture follows Cranz' (in Bhatt 2013) and Pallasmaa's (2012, 1994) indications.

Principle

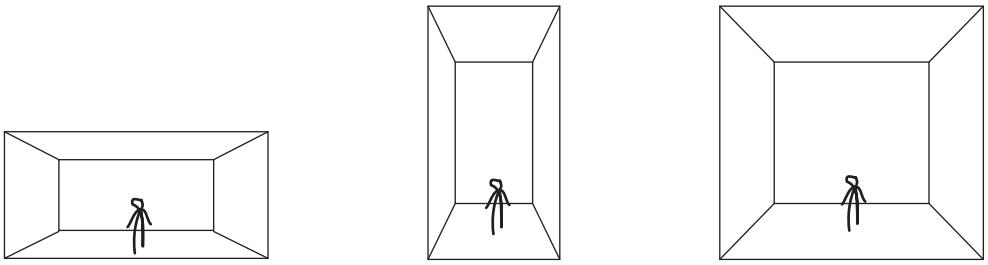
In this architecture, **the Raumplan is used to optimize the space** of the dwelling, **but also to divide different moments of the dwelling experience**, nonetheless **unified by the use of internal visual connections and materials** that propose themselves in new combinations in each locale, but using the same cluster of colours. Dimension of the space, materiality, and disposition of the volumes are the tools that the architect uses to create the sensuality and comfortability of the house. In the next pages each of the parameters will be analysed in order to build the understanding of Loos methodology focusing on the development of the living area. In it indeed Loos concentrated the efforts to create the **continuous internal journey of the dwelling experience** in a constant game of perspectives, levels and textures that applies the Raumplan method (Denti 2004).



Müller house, the internal journey in the living areas. Floor plans. 1-Entrance; 2-Warm room; 3-Cloackroom; 4-Living room; 5-Dining room; 6-Lounge; 7-Boudoir; 8-Library

Dimensions

In order to understand the relevance of dimension consideration in the sensuousness construction, suggested to this research by Cranz studies, a simple experiment that compares three volumes with different proportions has been done (see picture below).



Space large and short
(8X8X3 m) Typical room.
The room seems proportional and liveable for the usual activities of the dwelling experience.

Space thin and tall
(3X8X8 m) Hallway.
The room seems disproportional and encourage people to watch up and to walk through.

Space large and tall
(8X8X8 m) Showroom.
The room seems made for expositions, the human scale is forgotten to host representative activities.

Even if very simplified, the spaces show already a certain character and encourage visitors to a particular use of the locale and they suggest the possible activities that will take place on them, reinforcing the idea that dimensions are involved in the mental construction of the space comfortability. Applying these considerations to Müller House, **it is possible to relate dimensions and function,** according to the Modern Movement theory, **but also dimensions and emotion that the locales want to transmit to visitors** (see diagram below).

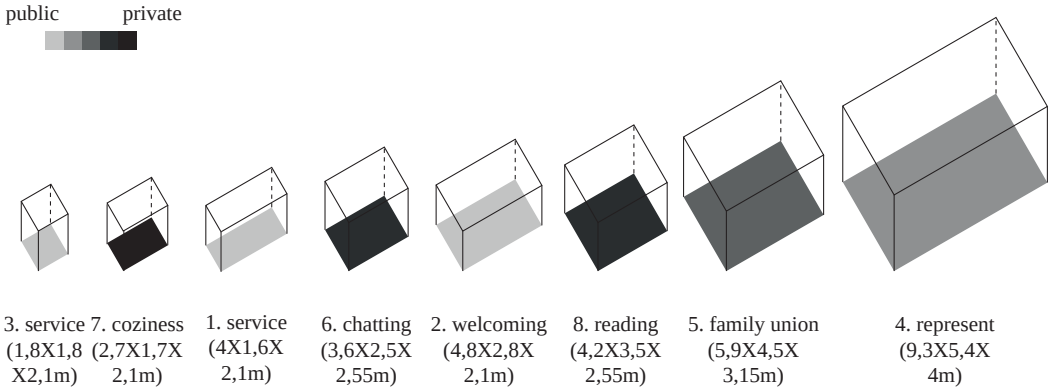
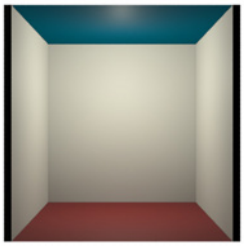


Diagram of the locales dimension.
The spaces are here presented organized by their dimension in both plan and elevation. The colour refers to their function, darker as it becomes more private. It is possible to notice how, excluded the service rooms of the entrance, the locales become smaller more is the sense of cosiness that the want to transmit.

The diagram above shows how each locale has particular dimensions, both in plan and in elevation. It is my claim that the dimensional difference in Müller House reflects on the previewed use of the space: more the room becomes private, smaller it gets in the three dimensions. In this way, it is clear that in Loos' House the **human body has a central role to scale the space and make it functional and comfortable**, in line with Cranz and Pallasmaa theories described before. Moreover, **the room's dimensions express a certain gesture**: on one hand, taking as example the locale of the main living room, thought to host guests, we can notice how it recalls the third space described in the general experiments above. Its dimensions are over-scaled in order to give the feeling of magnitude and importance to visitors; differently, taking a look to the boudoir space, private and intimate, the dimensions are contracted to suit again the human body and give the feeling of cosiness that encourage comfort and personal exchanges between people. Just in the same way it is possible to understand that Loos decided to give an increasing level of intimacy to dining room, library, and lounge, while he reduced to the minimum the dimensions of the service spaces, namely entrance, with proportions that remind the second space analysed in the general experiments, and cloakroom. The only exception is in the warm room, that is a public space, but at the same time a service space. For this reason its dimensions are not optimized till the minimum possible, but neither exaggerated till the maximum as in the living room.
As it is clear, in the spaces of Müller House dimensions are not exaggerated as in the theoretical ex-

periments done in the models above, nevertheless one can feel the same experiences of compression and expansion thanks to the fact that locales are positioned one after the other in such a way that differences are emphasized. More details about this concept will be analysed in the paragraph dedicated to dispositional strategies.

A similar study can be done relatively to materiality. As for the understanding of dimensions relevance, materials has been deepen first at a conceptual level, focusing on the sole colours (see appendix 1), and then through schematic models that apply different materials to some of the surfaces constituting the internal volume (see pictures below). Consequently, the general conclusions extracted have been compared to Müller House solutions in order to understand how the architect created the sensuousness of the space.



Polished marble cladding in a white frame.
The space appears rich and cleaned, but cold, suitable for representative spaces.

Soft flooring in a white volume.
The space appears warmer, but without character, suitable for service spaces.

Envelopping wood cladding.
The space appears warm and cosy, suitable for private spaces.

As suggested by Semper, Cranz and Pallasmaa, the conceptual study shows that simply applying a different cladding the spatial perception of the space changes becoming warmer, colder, more comfortable or encouraging certain activities more than others.
According to Frampton (1989), "Loos stresses the primacy of cladding over all considerations". This is remarkable in Müller House living spaces, in which **each locale uses a peculiar combination of colours, materials and textures according to its function**.

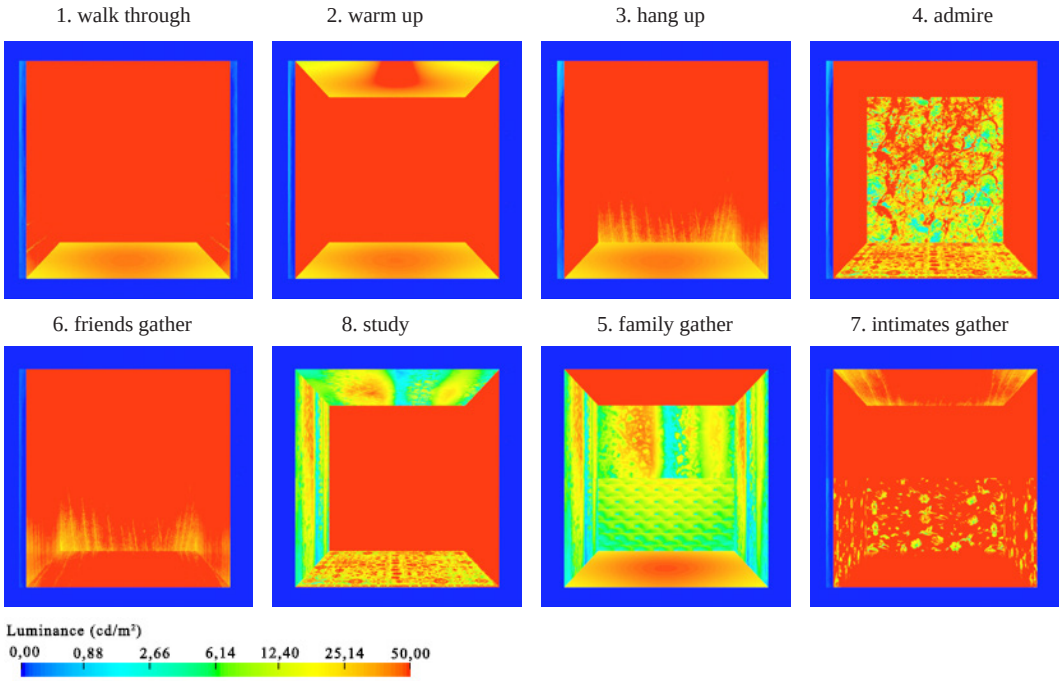
Diagram of the locales materiality.
The spaces are here organized according to the level of intimacy reached thanks to their materiality. The dimensions are homologue (4mX4mX4m) to focus the attention of the reader on the analysis of the definition of the space through colours and materials.

The diagram above simplifies the locales' space in order to make them comparable just through the materials used for cladding. The service spaces are less intimate, as well as the living room, that is meant to be the space for social gathering and wants to underline the importance of the family through the use of refined materials. In particular, it is possible to underline as in the example of the entrance space, reflective materials visually enlarge the space, while the colour of the side walls guide the visitor to the next room. Differently, **from the lounge to the boudoir we notice that the cladding becomes more and more embracing and 'warm'**, gradually applying soft materials. All

this considered, it is possible to say that in Müller House **materials are** not simple decorations, but are **the first involved in the spatial experience creation both visually and tactually**.

Luminance

In order to better understand the relevance of material choices in the creation of comfortability and sensuousness of the space, it is possible to look at the changes that the simple cladding with a different material can give to light level of the locale. The next series of pictures shows the spaces presented before in false colours. This strategy gives the amount of luminance of each space, in which the light source and position have not been changed, and neither have the dimensions of the room. The only modified parameter is the cladding of flat surfaces: glossy or glazed, and coloured.



Locales luminance according to materiality.
The spaces are here organized according to the level of intimacy reached thanks to their materiality and they are shown in false colours to show the luminance of the locales belonging from material choices. The dimensions are homologue (4mX-4mX4m) as well as the light source to focus the attention of the reader on the specific study on materials.

From the images we can say that the three biggest spaces, living room, dining room and library, are the one that use darker colours and with the lowest luminance. According to Meerwein studies (2007), this strategy gives the impression to users that the space is visually smaller, re-dimensioning the large spaces to the human scale.
Further reflections on light strategies can be done relatively to the relevance of interior connections and openings between the locales that compose Müller House, described in the next paragraphs. Even without specific calculations it is possible to understand at an intuitive level that the internal openings through the spaces allow a highest level of illumination of the spaces, improving the daylight of each locale. In this research, these light studies are omitted for synthesis reasons and because they are not a central focus of Loos approach, whereas their relevance is acknowledged and they will be part of the design process of future dwelling solutions.

Sound reverberation time

Another strategy to give sensuousness to the space linked to materials and dimensions is the creation of a certain **sound atmosphere**. As we can easily understand, at a general level the sound characteristics of a cathedral are radically different from the one of a dwelling space. The parameter that better describes those differences is the reverberation time of sound. In order to give a general indication, we can say that spaces designed for speech might have a reverberation time of 0,4-1,1 seconds (becoming dead spaces), while cathedrals and spaces for liturgical music generally have a reverberation time of more than 2 seconds (described as live spaces). The higher the reverberation time is, the more intimate is the atmosphere of the space; however also the echo effect risks to increase due to the dimensions of the space and the distance that might exist between sound source and final auditor. The diagram in the next page briefly shows the studies done on the sound reverberation time of the living areas (see Appendix 2). It is possible to notice how the reverberation time of the space increases with the increasing of the public vocation of each space. Once again, then, the technical characteristics of the room corresponds to a solution that aims to reach a specific gesture: the public space of the living room could host concerts and has a warm atmosphere, while the boudoir, thought just for private speech, is detailed as a dead space.
In order to understand the relevance of material choices in the atmospheric construction of the

space related to sound reverberation time, the library room has been taken as example to make transformations (see appendix 2.1).
Changing one parameter per time, which is the reflectivity of the main cladding material, the final reverberation time changes from the original 0,72 seconds to 1,04 s in the case with plaster cladding and 0,38 in the case of drapery cladding.

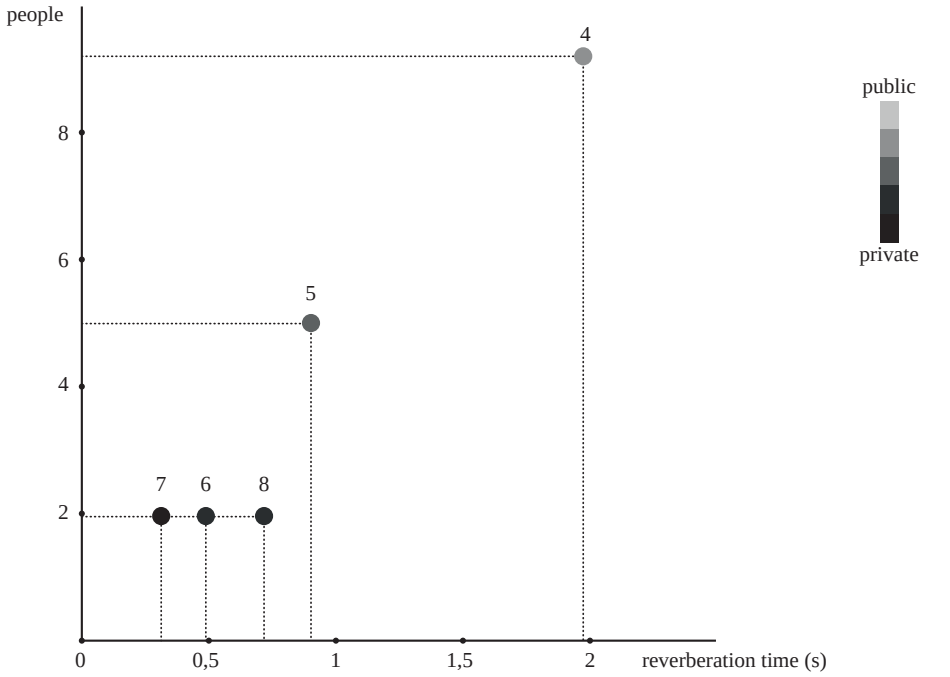
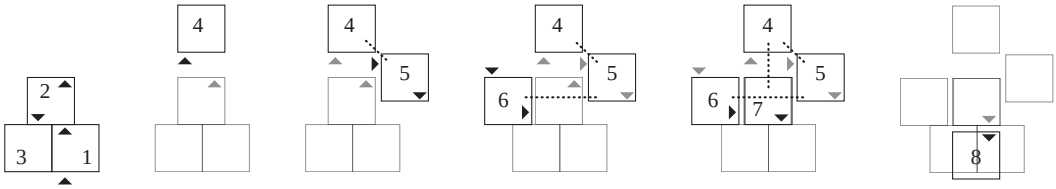


Diagram of the locales reverberation time.
The results of the calculations are here organized in order to show how the reverberation time of the house locales is proportional to the public vocation of each space.

Disposition

The reflection on the internal connections between the locales brings us to say that the emotions transmitted by the house interiors are linked with the disposition of the volumes in the space. The same Adolf Loos states that his architecture is not conceived in plan, but rather in terms of spaces or cubes, hence the Raum - or Space – plan, which achieves a merging of storeys and spaces into a contiguous and continuous space. Loos' theory of the Raumplan is here applied in order to both optimize the space and to create the interior journey named before. The dwelling experience becomes, in this way, an experience perceivable with all senses and in a synaesthetic way while walking around.

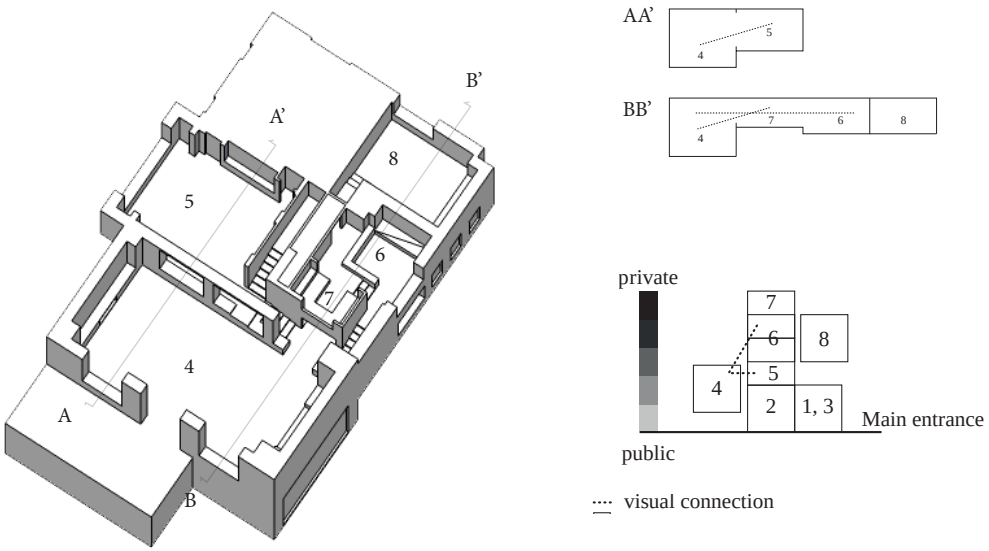


Scheme of the horizontal organization of the living spaces.

entrance
visual connection
room

The diagrams above have the goal to explain the rooms' relationships through simplified drawings of the plans, while in the next page axonometry and section organization of the house will complete the understanding.
As we can notice, in order to experience the house a visitor has to discover the rooms, as aimed by Pallasmaa (1994; 2012), walking through the spaces and feeling the passage between a space to another before with his feet, going up and down, and then with the rest of his body. Visual connections are also an important part of the house configuration. As Colquhoun writes (2002): "Spatial continuity between rooms was created not by omitting walls but by piercing them with wide openings so that views were always framed. […] Often the connection between rooms was only visual, as through a proscenium. At their interface, these spaces had a theatrical quality".
The visual connections anticipate to users the diagonal connections that they will experience in the inside journey, which in this way encourage a continuous discovering of the house.
Matching the dispositional strategies with the dimensional strategies, we can have a more complete

understanding of the inside experience of the house.



Axonometric section of the living spaces and schemes of the vertical organization of the living spaces with diagrammatic sections AA' and BB'.

The diagrams below show in schematic axonometries how **locales are presented one after the other to visitors emphasizing the feeling of compression and expansion of the spaces and completing the creation of the synaesthetic experience**.

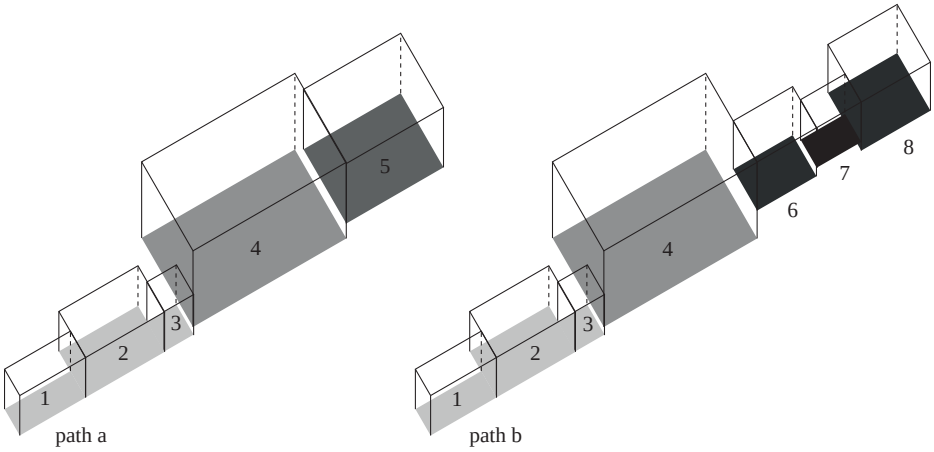


Diagram of the interior journey paths.
The spaces are here organized in sequence to show how they are presented to visitors according to two possible paths. Both dimensions and vertical disposition are taken into account in order to give an understanding of how visitors perceive compression and expansion of the space thanks to the passage through contrasting volumes and rise from public to private spaces.

It is possible to notice that small and big spaces are continuously alternated. As stated in the paragraph dedicated to dimensional studies, this strategy allow the architect to **give users the impression that locales are bigger or smaller than what they actually are thanks to the comparison that they do with the space crossed before**.
To give an example, we can imagine that going from the space 1, the entrance, narrow and long, to the space 2, the warm room, just larger, the visitor will have the impression to enter into a bigger space because of the change of proportions. In this way the problem of reducing dimensions of the service areas doesn't go in contrast with the need of welcoming the public. At the opposite, going from the wide space of the main living room (space 4) to the lounge (space 6), the last one will seem even smaller and more intimate.
Moreover, **the perception of the room dimensions is faked by the visual connections, that especially in the living room enlarge at the extreme the space already broad**.
The disposition of the rooms seems also to reflect the need for peacefulness of the singular spaces that Pallasmaa (1994) names in his studies. From the bottom to the top we observe the sequence of spaces that have a progressively higher need of silence from the entrance space (public) through the dining room (semi-public) till the library, meant for studying.

What makes the indoor space comfortable?

The principle here used to create the 'place to live' as the place of comfort, as can be read in the previous paragraphs, is mainly one: the Raumplan.

In order to develop the Raumplan, considerations on dimensions, materiality, and disposition, but also lightning, and noise level have been done.
Cladding is developed through studies on colours and texture as well as on light reflectivity and sound reverberation. But cladding in Loos gains a new meaning because applied to the carved walls and filling it creates the complex game of surfaces, volumes, wardrobes, and nooks that compose the house and that are the very centre of the dwelling experience that the architect claims. Cladding is not just a finishing of the walls, but sofas become part of it, cupboard are carved wooden plates in continuum with the wall surface and carpets are folded becoming steps.
It is impossible to separate furniture and cladding from the architecture without destroying the space because they construct it. In this way **cladding is in itself instrument of the Raumplan**.

In conclusion it is possible to say that Loos House is in line with Semper's indications, preemting Teige, Pallasmaa and Cranz theories in his architecture, which is sensuous, functional and comfortable. Dispositional strategies, expressed through the application of the Raumplan, seem to be generative and they are completed by specific studies on singular dimensions of the locales, cladding materials, investigated in their reflectivity, colour coherency, texture and preciosity, room light and sound atmosphere. Those studies should be applied to the design of dwellings in contemporary contexts and go beyond the density of the external environment, which could be both natural or urban. Applying the study to the design of a dense cluster of apartments in Milan, theme of the second part of this report, could mean to treat them as individual units that are composed by locales singularly studied in their dimensions and sensuousness, but unified by the same gesture of comfortability and by internal visual connections that contract and expand the space.
Nevertheless, there is a lack in considerations on the relationship between inside and outside space in Loos approach. The dwelling space here described is completely introvert. As a consequence, the link between inner and outer realities explicitly aimed by Pallasmaa in 1994 is partly negated. The integration between architecture and context could improve the overall result.
In the next chapters of the thesis this issues will be studied in order to implement Loos approach to dwelling.

2

PERMANENCE AND AUTHENTICITY

How to entrench the building in the realm?

The reading of critics theores done in the previous chapter underlined the necessity to detail the dwelling interiors in order to create the space of comfort of inhabitants. Nevertheless the case study of Müller House underlined the lack of an approach that watches at the indoor spaces alone in order to create architectures that, following the same Teige's, Cranz's, and Pallasmaa's theories, are strictly linked with the local culture and realm. Thus this chapter has the goal of **deepen the category of authenticity** named by Pallasmaa (1994) and gives practical indications on the way in which architects can create **building that link traditions and contemporaneity, but also between indoor and outdoor dwelling experience**. With this aim, very different approaches from Modernism, which considers the **social implications of architecture**, to Nordic architecture, which focuses on **cultural and environmental issues**, will be analysed and the category of **authenticity** will be better defined in order to show the existing **link between sensuousness and permanence of the architectural result**.

CHAPTER QUERIES

How are sensuousness and permanence linked?
Which is the link between authenticity and present social demand?
Which is the link between authenticity and past traditions?
How landscape is involved in the construction of permanence in architecture?
How are outdoor landscape and indoor sensuousness connected?

In the next page, a diagram synthetically visualizes the structure of the following chapter. The diagram builds upon the one presented at page 13 and associates to each keyword a logo that belongs from the Glossary. In this way it is a tool for readers to orient the understanding of the chapter contents anticipating them and showing the connections between themes.

Chapter structure

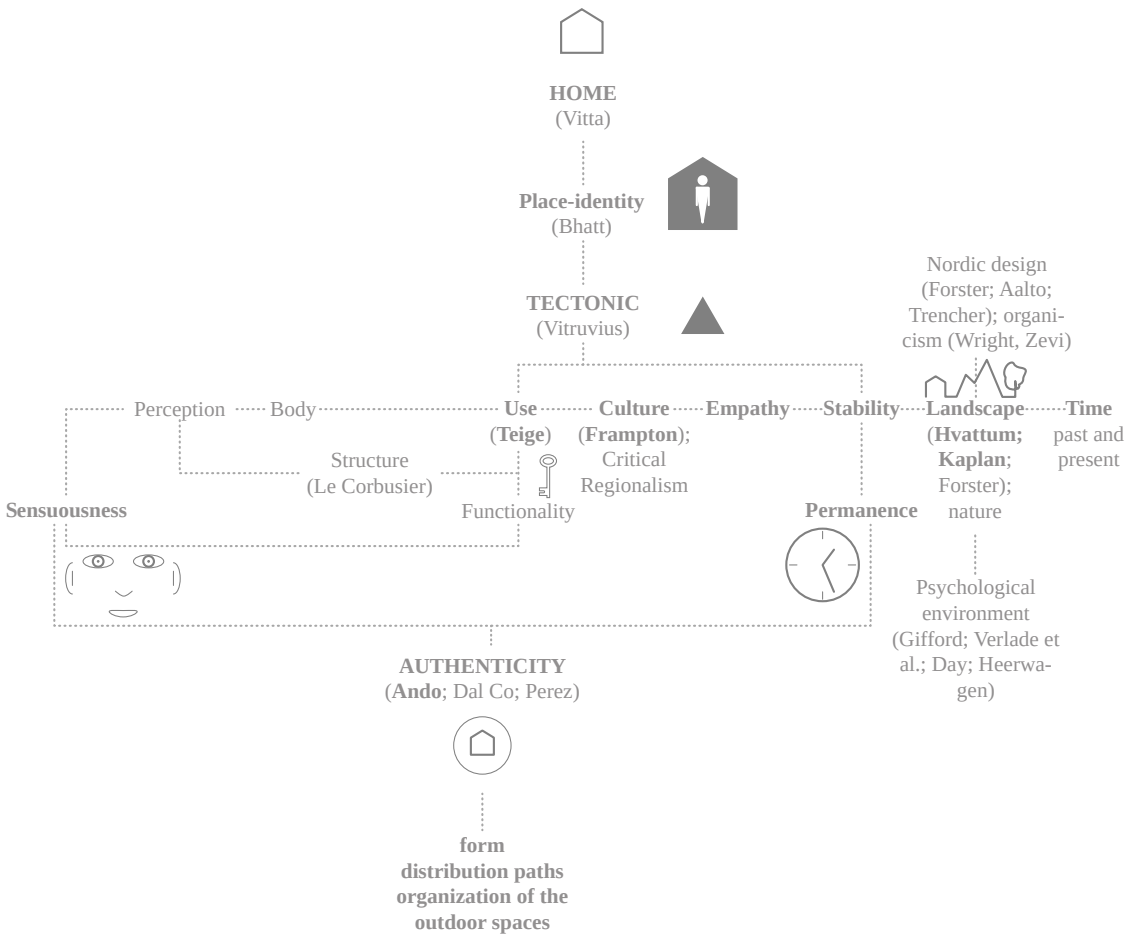


Diagram of the organization of the research related to the theme of Permanence and Authenticity. In bold, key-words and main authors. Logos refer to the Glossary.

As we already saw in the previous chapter, Modernism moved the focus of the architectural research from aesthetic issues to technical questions, emphasizing structure and functionality as tools to organize and rationalize the urban habitat. Teige's study (2002) focuses in particular on minimum apartments, that in his understanding should suit the modern workers. His research defines indeed design indications for the improvement of small flats, supported by practical examples, that start from the consideration that "The reform and modernization of small popular apartments by modern architecture made it abundantly clear that the problem of the minimum dwelling could not be solved by the mere reduction and simplification of the floor plan of the large apartments of the wealthy, whether traditional or modernized. Thus, it was not a question of simply reducing the number and size of rooms, or simplifying mechanical services and other amenities".

In his understanding, the first mistake of the modern approach to minimum flat solutions is that **all the housekeeping functions of the big dwelling are condensed inside the space of the kitchen**, retained the "basic functional element of a small apartment". The author thinks that the society changes substantially transformed the house in a place for living and rest, meaning that the flat should focus on the **living space as new starting point of the dwelling experience**. Consequently, he suggests to reduce the kitchen size, potentially until transforming it in a single furniture piece, to give the possibility to enlarge the living room. Moreover, he suggests to **balance the time of use of the spaces** according to lifestyle, work schedule, and family conditions of the classes of subsistence minimum in which "people today spend most of their time outside the home, returning there by and large only to sleep". In order to do that, architects should match on one side the spaces of kitchen and dining room, and on the other bedroom and living room. For the same reason, he considers **the small apartment allowed to serve the private functions alone, while communal facilities** (canteens, cafeterias, snack bars etc) **should be its natural extension.** Following this logic, some of the functions that are traditionally part of a bourgeois apartment might be move outside the minimum flat (for example the clothes washing) in order to save both costs and space. In other words, the minimum flat solutions proposed by the author don't copy the layout of medium or large size apartments, but aim to the creation of a new typology with its own inherent dwelling standards. The dimension of the small apartment is enlarged toward outside in the city, requiring new urban considerations and not only architectural ones in a holistic conception of design.

In this case, the authenticity of the architectural result lies in the unbreakable link between social demands and architectural answer, also resumed by Cranz and Pallasmaa. But the form of architecture does not respect local traditions, habits, and cultures, because it is focused on the creation of universal answers that break with the past and, literally, build on a *tabula rasa*.

Embracing Modernist conception of the architectural nature, which defines it as primarily construction and "only later an abstract discourse based on surface, volume and plan" (LeCorbusier 2009)[1], in 1995 Kenneth Frampton writes the book *Studies in tectonic Culture*, in which he sustains the necessity to reconsider

1 According to this statement and bringing it to its extremes, in 1923 in *Vers une architecture,* Le Corbusier considers architecture as a modern machine and decomposes its components in basic construction elements.

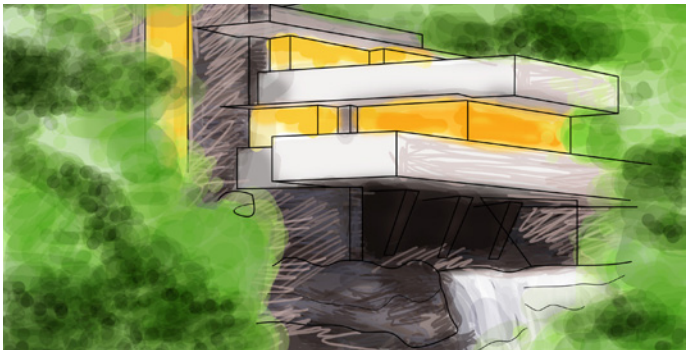
The minimum dwelling

Functional building to solve the dwelling issue.
External perspective interpretation of l'Unité d'Habitation, by Le Corbusier 1946-52, Marseille. The building is a great example of functionalism, characteristic of the Modern Movement and propose a new interpretation of the urban life creating vertical massive cities (including public and private facilities) surrounded by nature that represent a perfect example of Teige theory. The complex combination of dwelling modules are studied to reduce to the minimum the interior spaces of the single units as well as the totality of the distribution paths.

TEIGE'S INDICATIONS:

The minimum flat should be shaped starting from the living space and might guarantee a certain subdivision of functions. Moreover, it should serve the private functions alone, leaving public activities to external facilities.

Critical Regionalism



Integration between building and nature.
Perspective visualization of the Falling Water House, by Frank Lloyd Wright 1936-39. The house, designed for the Kaufmann family, stretches out over a waterfall that becomes part of the inhabitants everyday life. The villa melts with the landscape and build it. In this way, Wright brought to the world attention a new style of architecture that refuse the universality of Modernism, and seems to rediscover the place in which it is placed, use it and increase its density of signification in line with Frampton research for Critical Regionalism.

FRAMPTON'S INDICATIONS:

Structure and construction in their expressive potential that might be first instrument of architectural expression. Technological innovations improve traditional systems that nevertheless might be acknowledged and revisited in modern ways in order to link contemporary architectures and cultural background.

structure and constructional modes in their expressionist value. While, as we already described, Loos was interested in constructive methods only in the measure in which they allowed him to build the space that he wanted, Frampton asks architects to **re-integrate structure and construction in the design process to create the space 'through' them**, not just 'with' them.
However, the author redimensions the extremism of Modernist discourse, which has the risk to reduce the discussion on architecture to a mere list of technical solutions to apply while designing. In *Prospects for a critical regionalism* (Frampton 1983), he brings position against the Modernist attitude to create architectures as self-standing objects on a *tabula rasa*, underlining **the importance for architecture of being rooted** in the space in which it is placed in order to allow the **identification of people with the space in which they live**. Frampton argues, in fact, that the universal Megalopolis in which for decades architects tried to make us living is antipathetic to a dense differentiation of culture: "It intends, in fact, the reduction of the environment to nothing but commodity". In this scenario, Frampton understands nature as reduced to an instrument, instead of a potential or a base on which we can found our culture. The author asks: "how to become modern and to return to source; how to revive an old, dormant civilization and take part in universal civilization?".
If the questions posed by Frampton in his paper could seem paradoxical and containing an insolvable oxymoron, the history of architecture already showed us that is possible to find answers.
Against the homologation of the worst Modernism, the Organicism movement proposed since the 30s architectures strongly linked to the context. Promoted in first place by the American Frank Lloyd Wright, the theme of organic architecture was developed also by Alvar Aalto that tried to **re-humanize Modernism through a mitigation of its teaching with the Scandinavian tradition** in buildings (Trencher 1996). This attitude exactly describes what Frampton names 'Critical Regionalism' specifying that "**its salient cultural precept is 'place' creation" through the link of old traditions and culture with the contemporary space and society** (Frampton 1983).

Simplicity and contrast

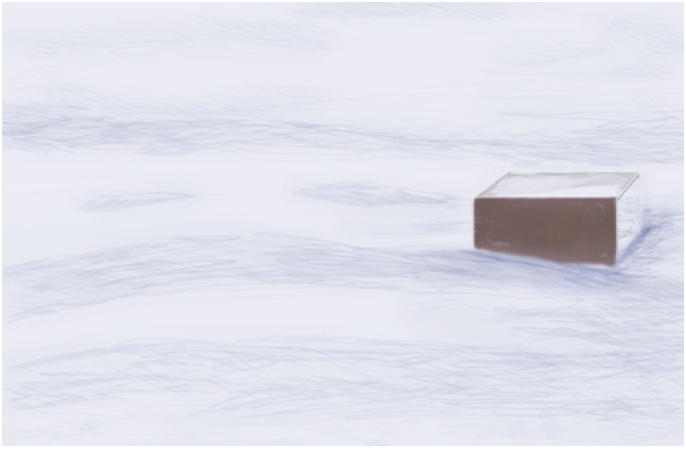
The discussion on national, regional or local architecture is strongly defended also by contemporary Scandinavian architects, that from Aalto started being noticed at a global level precisely for their "remarkable ideas [that] tend to be embedded in the familiar townscape rather than detached from it" and "propose thoughtful responses to practical issues" (Forster K. 2012).
Nordic architecture seems indeed to embrace the position of Frampton on Critical Regionalism, trying to reach the result of **union between past and future through an always alive sensibility for materials and the creation of spaces that are open to the outside, site-related, and delicate** (Forster K. 2012). As Kurt Forster noticed, Nordic architecture results create spaces that seem to "extend the possibilities of organic continuity by means of sliding scale throughout their interiors, negotiating the necessary transition from public presence to the personal experience of wandering through a building or taking a seat inside it".
"Simultaneously rooted and innovative", as Mari Hvattum says validating Forster's position, Nordic architecture became famous for the honest use of materials, the didactic clarity of the tectonic composition, and the particular affinity to place, considered in its climatic, topographical, and geographical characteristics, which brought critics to describe it as "naturally" grown from the ground (Hvattum 2012). **Authenticity**, as meant by Pallasmaa, **and simplicity seem to be the keywords of Nordic design**; however, Hvattum calls the expression 'natural building', often

link to Nordic architectures, into question: "How can something as artificial and complex as a building be described as 'natural'?". Her critical study on Nordic architecture underlines how the geographical characteristics of Scandinavian Countries became, in the XX century, the reason to justify a claim of moral superiority of the northern cultures[1]. For the author, this was the realm in which topographical, geographical, and climatic specificity became a "moral imperative" for Nordic architecture and a "measure of its authenticity", defining a sort of "tyranny of place". On the other hand, Hvattum notices how **the new generation of Nordic architects is emancipating from this tyranny, invoking a reinterpretation of the natural landscape** through the use of new technologies and constructive methods. The aim of the new architects is to emphasize a peculiar social culture and create a new landscape, both natural and artificial, that looks to wider horizons. In the new Scandinavian architecture, in the author understanding, **the natural presence is presented to visitors in a surprising way and encourages an active exploration** of the space instead of a passive landscape observation. Hence as at the apartment level Cranz (in Bhatt 2013) underlined the importance of changes for the mind involvement of inhabitants, Hvattum notices that differences at the landscape scale stimulate visitors. Also in this case, users stimulation is obtained **through the creation of spaces that use colours, materials and shapes that are in contrast with the natural landscape**, but sharply **detailed in order to emphasize the presence of the built environment and at the same time enrich the natural one adding new meanings to it**.

In conclusion, Hvattum interprets the attitude of new architects as the proof that "architecture does not have to mimic a predefined 'genius' to be contextual" and he specifies: "Nordic architecture is informed, inspired, and conceived in a relationship with nature, and is often situated on exquisite natural sites. Yet there is nothing 'natural' about the precise geometry, the careful manipulation of materials and colours, or the highly cultivated plans, sections, and facades that we have looked at above. This is an architecture that effectively debunks the myths of authenticity and 'naturalness' that surrounds Nordic building, replacing it with a far more interesting kind of contextualism. [...] To envision architecture as a mimetic re-enactment of topographical form is to underestimate what actually makes a place, namely **layers of human action, sediment in memory, language, customs, and physical form**. **Architecture creates new places** - and recreates old ones - forever negotiating and reinterpreting the meaning of both nature and place"[2].

Clearly, the reflections of Frampton and Hvattum on the necessity of a new kind of authenticity in building can be applied to architectures that are both in natural and in urban environments and could inform Teige's discourse on the social aim of architecture.

Nevertheless, the same Hvattum underlines that Nordic architecture is generally placed in natural landscapes, and it is impossible to deny that the natural environment of those constructions



Contrast as tool for authenticity.
Interpretation drawing of the Norwegian Wild Reindeer Pavilion, by Snøhetta 2009-2011, Tverrfjellhytta. The building design is based on a contrast between ideas - a rigid outer shell and a soft, organic inner core. Hence, if the indoor space mimic with soft wooden curves the rocks eroded by wind and water, from the outside visitors can notice the rigid steel frame and the reflective glass of the only window. The exterior materials are extraneous of the landscape, but not less authentic in Hvattum understanding, since they underline the human presence in the natural landscape.

HVATTUM'S INDICATIONS:

To create authentic architectures is necessary to emphasize both natural and artificial elements of the landscape through the appropriate use of colours, materials, and shapes. In this way new landscape elements will be integrated part of the territory not miming it, but re-building it in an innovative way and showing it to visitors in unexpected forms.

Environmental psychology

1 Hvattum critically refers to Bernhard Cotta, Wilhelm Heinrich Riehl, and Aasmund Olavsson Vinje that studied from different fields the climate and the landscape of Nordic Countries in order to promote and demonstrate their cultural and moral superiority compared to other European cultures. (Hvattum 2012)

2 As underlined in the text written in 2010 by the Landscape Institute, the UK Government defines landscape as "an area, as perceived by people, whose character is the result of the action and interaction of human and/or natural factors". This definition, in line with Hvattum understanding, recognises the dynamic nature of landscape, and emphasises the necessity for architects to manage the changes in order to create new landscapes. A deeper understanding on the architectural methods to manage changes will be approached in the next chapter of this thesis.

A

B

C

The restorative environment.
Personal interpretation of different views from windows. Kaplan studies show how, even if users preferences are not completely predictable because subjective, most people would prefer the second and third view from a window compared to the first one.
A represents a view on a building (in this case, the facade of a building in Via Crivelli, Milan); B represents a view on a boulevard (in this case, the drawing sketches Viale Lombardia, Milan); C represents a view on a park (in this case, the drawing shows a detail of Parco Lambro, Milan).

is part of their success and sensuousness. For this reason I personally consider fundamental to understand which is the role of nature in the creation of the architectural experience in order to be able to apply strategies of integration between natural and artificial in cities environments.
Several are the studies that approach the theme of the influence between green environment and psychological comfort.
As Linda Day (2000) explains in her paper *Choosing a House: The Relationship between Dwelling Type, Perception of Privacy and Residential Satisfaction*, "**environment behaviour theory seeks to explain the relationship between people and place and the mechanisms that link them**. It builds on empirical-inductive studies that ask what planning and design professionals need to know about people to design for them, how environments affect people, and what mechanisms link people and environments".
One of the mayor researchers on environmental behaviour theory is Stephen Kaplan (1992; 1995), which reflects on the distance existing between people and nature (due to advances in technology, knowledge explosion, and increasing of world population), and on the **necessity of reconnecting ourselves with the natural environment in order to find our own well-being and reduce mental fatigue**.
In his theory indeed, mental fatigue can be reduced through restorative experiences, which have a special connection to natural environments. To demonstrate this hypothesis, Kaplan refers to the experience of some people participating to a wilderness program. From the participants' feedbacks registered, the author extracts some general understandings: **being away** (mentally, more then physically)**, extent** (the sense of being connected with the place)**, fascination** (that stimulate involuntary attention instead of forced concentration)**, and compatibility** (the support of the environment to do what one means to do) **are the keywords for a stress reduction**. As the same Kaplan notices, "although the restorative environment is by no means restricted to natural settings, **natural environments seem to be particularly restorative**".
Validating this theory, Frances E. Kuo and Roger S. Ulrich tested nature impact on people. Their researches are summarized in Rebecca Clay's article *Green is good for you* (2001) that explains how on one hand Kuo proved that even "isolated pockets of green containing just the bare bones of grass and a tree" helped the children living in Chicago to mitigate the negative impact of unpleasant urban environments, ensuring them a better capability of concentration and control on impulses; on the other hand Ulrich focused on hospital patients recovering from abdominal surgery to study the influence of nature on body heal, demonstrating that "patients whose hospital rooms overlooked trees had an easier time recovering than those whose rooms overlooked brick walls".
Having this thesis the aim to answer questions related to dwelling in dense urban environment, the results of Kuo and Ulrich, together with Kaplan's reflections on the **importance of accessibility of natural spaces** are fundamental. Kaplan writes: "It is interesting to consider the many patterns of relating to the natural setting. [...] A nearby, highly accessible natural environment cannot provide the context for all of these goals and purposes. Yet even such a setting is likely to be supportive of the inclinations of those who seek a respite there. It is amusing to think of the factory worker who races off during the lunch period, fighting traffic and distractions, to find a spot in the shade of a tree for a peaceful break. If the peaceful effect would have been totally worn off by the time the return trip is made at the end of the hour, would this ritual be repeated again tomorrow?" (Kaplan 1992).
Moreover, the author underlines the similarities of effects that

gardens and wild environments have on people, saying: "Even a relatively small area can provide a feeling of extent. Trails and paths can be arranged so that a small area seems much greater. Miniaturization provides another device for providing a feeling of being in a whole different world, though the area is in itself not extensive. Japanese gardens sometimes combine both of these devices in giving the sense of scope as well as connectedness". In conclusion, Kaplan emphasizes that to enjoy the positive effects of nature on our psychology we don't need wilderness, but also a window with a natural view helps.
In this perspective, **detailing and composition considerations seem to gain a bigger importance**[1], because architects are asked to **exceed the sole dimension of the built room and include in the lived space the world outside the walls in order to create a coherent landscape.**

KAPLAN'S INDICATIONS:

Mental fatigue is reduced thanks to the link between people and nature. In order to restore ourselves through the contact with natural environments we need them to be accessible, near, compatible with the use that we want them to have, and visible.

Further reflections

Reinforcing the concept, in 2010 the UK Landscape Institute notices how the fabric of landscape is primarily influenced by housing developments. For this reason, it declares that architects approaching dwelling design and aiming for environmental and social benefits, in line with Teige understanding, can not exclude considerations at the urban scale. The institute theory, that seems to belong from the researches of several theorists of the XX century[2], promotes the creation of "multifunctional landscapes" to encourage citizens in the appropriation of the urban space through a direct involvement in its creation[3]. First place of the citizens' involvement is the park, which represents, together with the public square, the space for the community gathering and interaction. Even recognising the importance of urban considerations and in particular acknowledging the main role of parks in the urban environment construction, this theoretical research will not deepen the theme to concentrate more specifically on the indoor dwelling space and the building scale. Nevertheless, in the design phase of the thesis those urban considerations will be taken into account.
Furthermore, it is important to notice that the theme of environmental psychology is strictly linked to the one of sustainability, as largely explained, between the others, by Judith Heerwagen in her *Green buildings: a strategic perspective* (2000). Even if her research refers to work environments, the author shows how not only the natural view, but also daylight and natural ventilation, are important factors in the inhabitants wellness and by consequence in the production efficiency. For synthesis reasons, this field will not be investigated in this part of the research, but considerations about sustainability, including calculations of the buildings performances, will be included in the project design.

The relation built/realm

It is possible at this point to summarize the indications of the different critics described in this chapter, summed up in the diagram that follows, and compare their indications with the strategies analysed in the section before.

1 Specific studies on the theme of spatial configuration of the landscape and its perception by users, even considering their preferences, have been summarized by Stephen and Rachel Kaplan in their book *The experience of Nature, A Psychological Perspective* (1989). Nevertheless, in the book doesn't appear a clear design strategy, since different classes of users answered differently to the settings proposed. The only general conclusion is that people prefer natural settings than artificial ones.

2 Between the others: Herztberger's public spaces (described in Sutherland 2013), van Eyck's playgrounds (described in Oudenampsen 2010), Team X mat-buildings (described in Ferres Forès 2011 and Calabuig, Gomez, and Ramos 2013; theorized in Smithson 1974), and Alexander's urban patterns (Alexander 1977).

3 Further reflections on the ways to involve users in the dwelling design process in order to create the feeling of home as place-identity and adapt the building to the momentariness of culture will be presented in the next chapter *Functionality and Flexibility.*

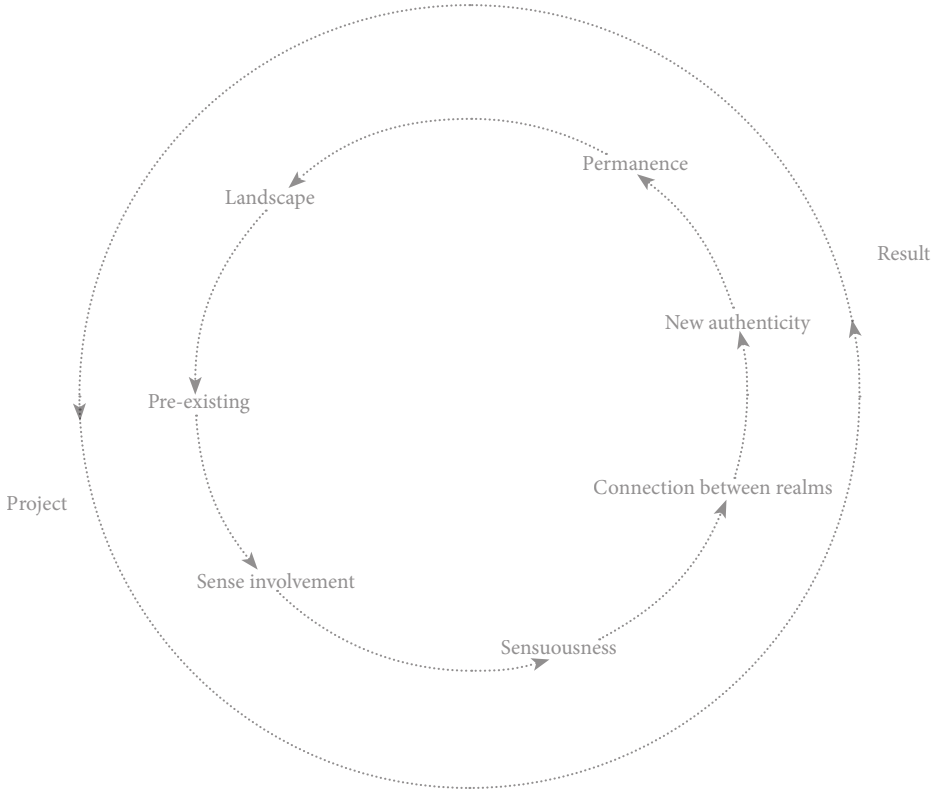
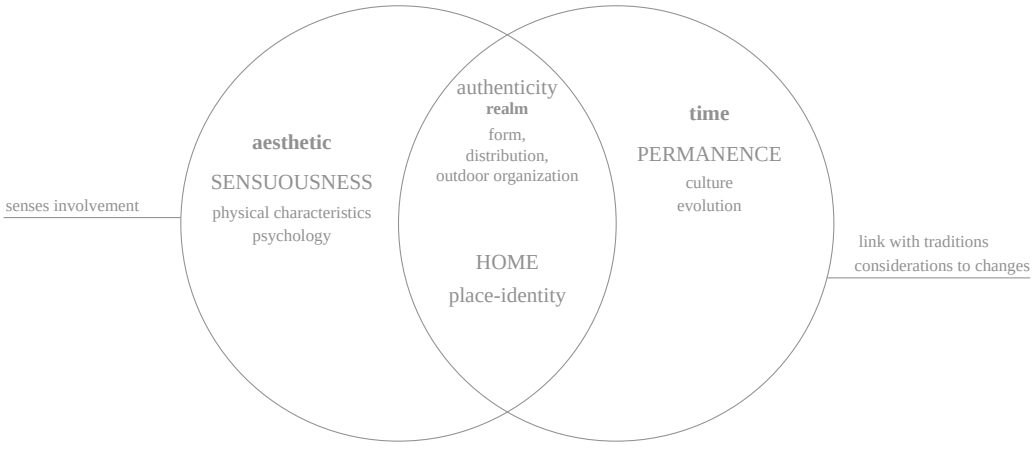


Diagram of relations between Landscape, Sensuousness, Authenticity and Permanence in architecture.

Teige's study introduces in the modern architectural debate considerations related to the **exchange between indoor and outdoor urban spaces** in order to give the appropriate room to private and public functions, speaking about the relationship dwelling/city. Moreover, he understands the indoor spaces in relation with the realm of the overall built environment, considering the relation apartment/building. On the same line of thoughts, Frampton, Hvattum and Kaplan emphasize the **importance of including landscape considerations in the design process**, speaking respectively about the relations architecture/culture, building/nature, and nature/psychology.
The first relationship is evident in the use of traditional forms or local materials in the architectural result, that could anyway be re-interpreted in a contemporary way mixing and modifying them with new solutions or technologies.
The second relationship asks to respect and emphasize the natural environment in which new buildings are placed through the honest and authentic use of shapes (against natural imitations), materials, and colours.
Finally, the last relationship considers the relevance of natural space organization for the human well-being, asking for accessible, near, and well-organized green outdoor spaces.
Generalizing, in my opinion the analysis of architectures that wants to focus on the characteristics that make them not just comfortable but also authentic has to deepen the understanding of the **relation built/realm**.

How to entrench the building in the realm?

We can give a definition of authenticity as the property of the space of being sensuous and rooted, hence permanent (see diagram below).



Thus an authentic architecture is able to involve users senses thanks to its property of relate to the existing realm and therefore becomes the link between past and future culture aimed by Frampton, but also Pallasmaa and Vitta (see previous chapters). The diagram above visually represents the relationship sensuousness-permanence-authenticity recognized by the present research.
The informations collected through the bibliographic review, similarly to what has been done in the previous chapter dedicated to sensuousness and comfort, have been used to define a specific methodology to analyse architectural project with the aim to show how they solve the relation with contemporary realm.
As stated before, the general scheme of analysis of the present essay follows Hvejsel one (Hvejsel 2012), describing: **function**, to explain the functional qualities of the architectural gesture; **emotion**, to describe the emotional qualities of the architecture; **realm**, to explain the contextual implications of the architecture; **construct**, to analyse the constructive techniques used; and **principle**, in which it is explained how the architectural gesture is revealed through a constructive principle.
Wanting to concentrate on the study of authenticity, the principles investigated will allow to firstly focus on the building scale analysing **the relation building/landscape** (a generalization of the relations dwelling/city of Teige and building/nature described by Hvattum); secondly they will concentrate on the apartment scale studying the **relations apartment/building**, borrowed from Teige, and **apartment/landscape**. Namely the investigated parameters will be:

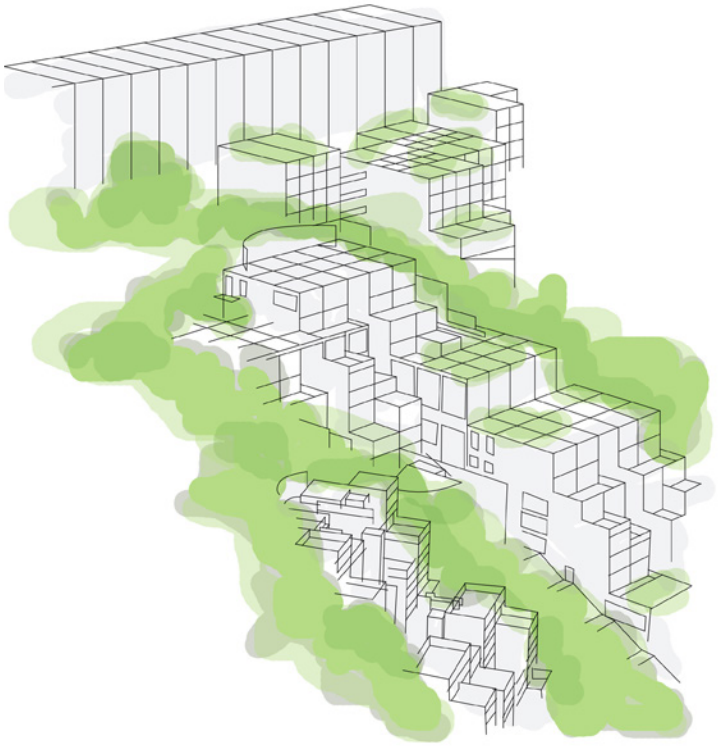
- **Form** (orientation and shape) of the building;
- **Distribution** (functional separation and paths) of the indoor spaces;
- **Organization of the outdoor space** (proximity, accessibility, visibility).

The building form indeed gives the first informations about the attitude of the architect to the surrounding landscape, that could be neglected, respected or emphasized.
The distribution paths, of course linked with the functionality of the building and of the apartment, are linked to the concept of architectural authenticity because they can be shaped according to contextual physical characteristics of the space and not only according to the use of the indoor space or aesthetic expression of the building.
Finally, the organization of terraces and gardens can stimulate a certain relationship with the outdoor spaces and the context, defining private, semi-private or public spaces.
In this way it appears clear that authenticity in strictly linked with the concept of sensuousness of the space, but can not be separated from the research of functionality defined in the first chapter because the authentic home space is also the space of comfort.

Together with Aalto, one of the main exponents of the Critical Regionalism movement is Tadao Ando, that has been here selected as the author that better represents the application of the theories related to Permanence and Authenticity in dense environments.
The case study that will be analysed is the Rokko Housing complex, built in three phases with a mixture of middle-low, middle, and high-density housing. Giving a general overview of the project, the analysis will focus on the second area built in order to show the strategies that guided the external and internal organization of the architecture. While linking the indoor strategies with the one previously analysed in Loos case study.
Some experiments will be done in order to understand how modifications in the formal aspects of the architecture could modify its general coherency with the themes of Permanence and Authenticity.

ANDO'S ANSWER

Case study: Tadao Ando, Rokko Housing (1983-1999)



How formal aspects influence the perception of home as authentic space?

Function

The housing complex on Rokko Mountain, just outside Kobe, is a compound of different dwelling solutions organized in three buildings built in three phases (phase I 1978-83; phase II 1985-93; phase III 1992-99) that go from low to high density and address to different users life-styles. Each of the buildings finds a peculiar declination of dwelling solutions, but always respecting the presence of the mountain, true protagonist of the scene.

Emotion

In this complex Ando wants to realize his vision of dwelling space as a spiritual place in which inhabitants can find their place-identity. In his understanding, "the opportunity to communicate with nature" has a central role in the construction of sensuous spaces that are related with the cultural context in which they are placed, but also to create homes in which you can feel peace and comfort. He explains: "Architecture represents an autonomous system of thought. To think architecturally is not merely to deal with external conditions or to solve functional problems. I am convinced that architects must train themselves to ask fundamental questions, to give free rein to their individual architectural imaginations, and to consider human beings, life, history, tradition, and climate. We must create architectural spaces in which man can experience—as he does through poetry or music—surprise, discovery, intellectual stimulation, peace and the joy of life" (Ando 2007).

Realm

His research for spaces to experience brings Ando to take a position against the Modern Movement. Is Ando again that explains this point saying: "What I wanted to challenge was the city of reality, a city full of contradictions that could not be governed by the transparent logic of modernism. What I wanted to create was absurd spaces full of raw vitality" (Ando 2007). In this way, the link between Ando's approach and Loos one is stated and in the same time is clarified the distance between the architect and the part of the Modenist Style that became mechanical instead of inspiring. Ando's goal is to create a post-modern architecture that "recover the formal richness that modernism appeared to have discarded" (Ando 1991). However, this does not mean to develop a formalistic play; in the opposite he wants to give shape to "the kind of abstract, meditative vitality that marked its beginnings, and creating something thought-provoking that will carry our age forward into the twenty-first century" (Ando 1991).

Construct

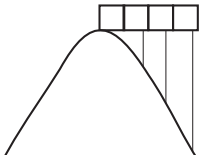
The result of this approach in Rokko is a complex warren of terraces, balconies, and atriums. The design illustrates a research for symmetry on a irregular topography that produces a dynamic architectural order (Dal Co 1995) and interpret traditional architectural strategies as the combination of solid and void to create a site-specific cluster. Buildings are, as usual in Ando architecture, in rough concrete and are composed by modules that adapt to the verdant surrounding and slope changes. Rokko complex I follows a grid of 5,4X4,8 m; Rokko complexes II and III found on a grid of 5,2X5,2 m.

Principle

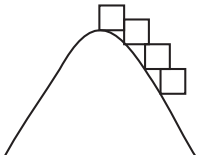
The gesture of giving shape to the world diversity translates, especially in phases I and II, in the composition of a multitude of flat solutions: 20 apartment layouts, different in composition and size, are assembled in the first phase; 50 units compose the second building. In phase III, bigger and composed by three wings of different rise density, instead of apartment differentiation there's a special awareness given by the architect to enriching the public spaces between the wings stimulating in this way public life by inhabitants. Being authenticity the focus of this section of the thesis research, in the next pages the analysis of Ando architecture will focus on complex II because, as stated by Ando himself, is the complex in which the architectural gesture could be better express without severe setback lines and other legal restrictions the characterise the complex I and it does not have the same extension of complex III, in which the architect could not design all the apartments as diverse units. The study will explain point by point how form, distribution and outdoor organization of the building cluster reflect the research for authenticity of the author.

Form

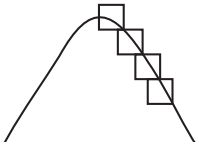
The shape of the complex is surely the first indicator of Ando research for a site-specific architecture. The units that compose the building of phase II are studied and realized to merge with the 60-degree slope of Rokko mountain and re-build its landscape. They are setted in it. Adapting the grid to the steepness of the slope generates asymmetries in plan and section that nonetheless contributes to the perception of the space - natural and artificial - as a whole. In order to understand at a general level the concept, the following diagram shows different possible approaches to a slopped context.



Negation of the context.
The building is designed disregarding the contextual characteristics of landscape.

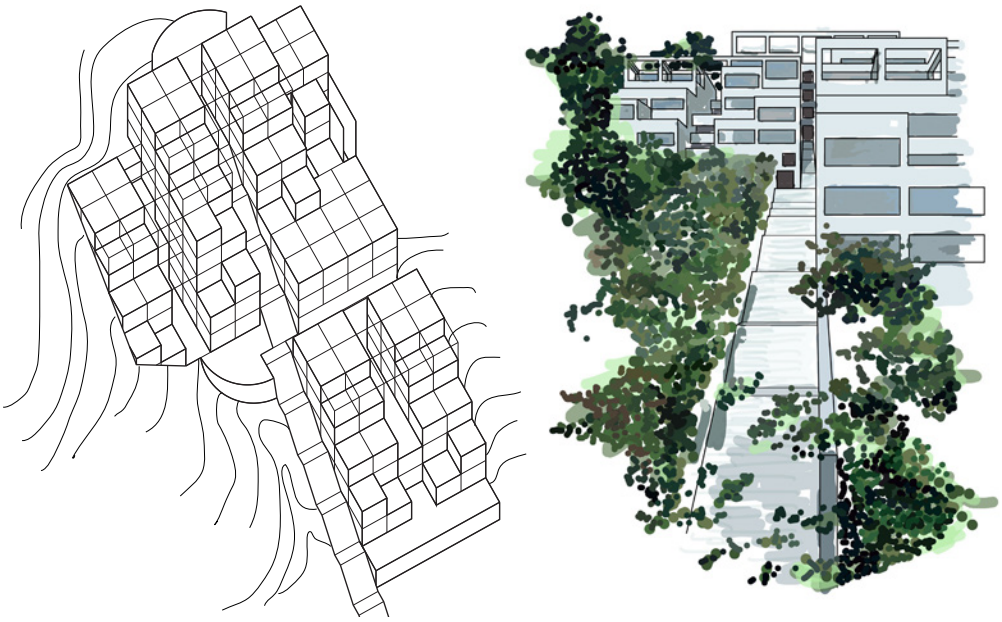


Respect of the context.
The building is designed considering landscape and respecting reducing to the minimum interferences with it.



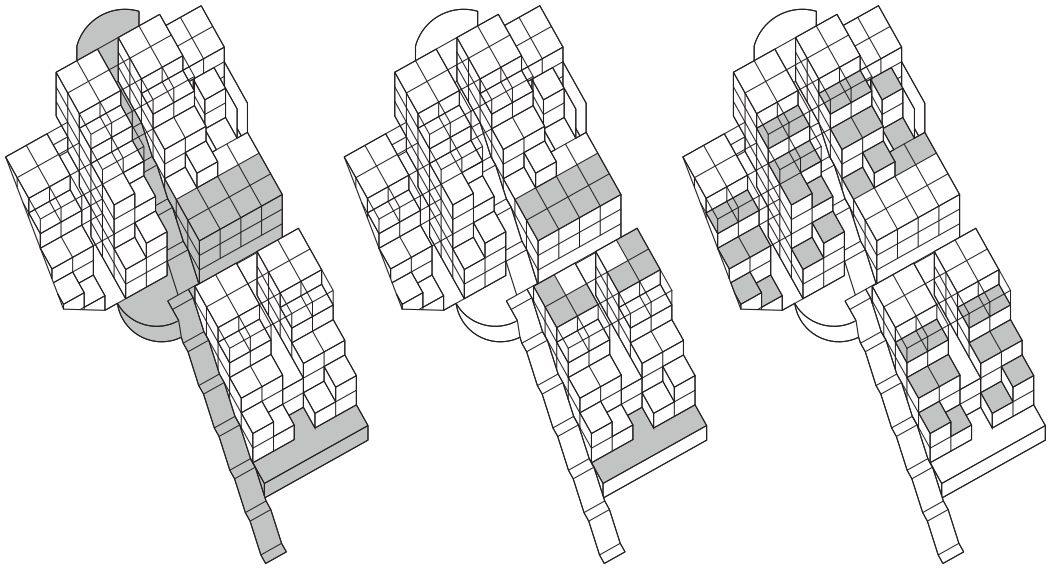
Construction of the context.
The building is designed considering landscape with the aim to enrich and rebuild it to create a new territory.

As we can see, imagining to build on a steep slope it is possible to create an architecture that simply adapts the structure to the slope, that becomes a problem instead of a potential, or to work with the slope. In this last option two approaches are possible: building on the top of the natural landscape modifying it as less as possible, thinking to architecture as 'temporary' and still separated from nature, or modify it heavily through architecture, but creating an indivisible whole.
Ando Rokko complex, in line with Hvattum indications explained through the bibliographic review of this chapter, chooses the third option (see axonometry diagrams). The rigid concrete structural grid gives a standard square measure to the complex, but shifts according to the terrain, generating variations along the axes of the marginal spaces. Moreover, curves soft the shape of the building.



Axonometry and sketch of Rokko Housing complex II

The central staircase, which transform the wild slope in a pedestrian path, creates a North-South gap that organizes the cluster of units in two wings and provides communal spaces (like the rooftop plaza and the pool) with a view to the ocean and open to people from the neighbourhood as well as to residents. In this way, the building has the social vocation aimed by Teige (2002). But the detail of the staircase does not have only a functional aim. Its slope, entrenched in the context, emphasizes the one of the mountain, creating the whole architecture-nature in the building of a new landscape. The modularity of the apartment units as well scans the path and visually underlines the growth of the nature around the artificial and supports it.



A - Public spaces B - Green roofs C - Private terraces

Green roofs complete the integration building-nature in the verdant landscape and gives a better view from the flat units to outside mitigating the artificiality of the architecture. Moreover, each

apartment has the direct access to a private terrace (see axonometric diagrams in the previous page). This two last aspects will be better explained in the paragraph related to outdoor spaces organization.

The formal strategy allows satisfactory lighting and ventilation to the apartments underlining once again the continuous relationship between landscape scale and apartment scale of the project.

Distribution

In order to deepen the understanding of the relevance of distribution choices in relation with contextual landscape characteristics and internal organization, a study on available options has been done also in this case.

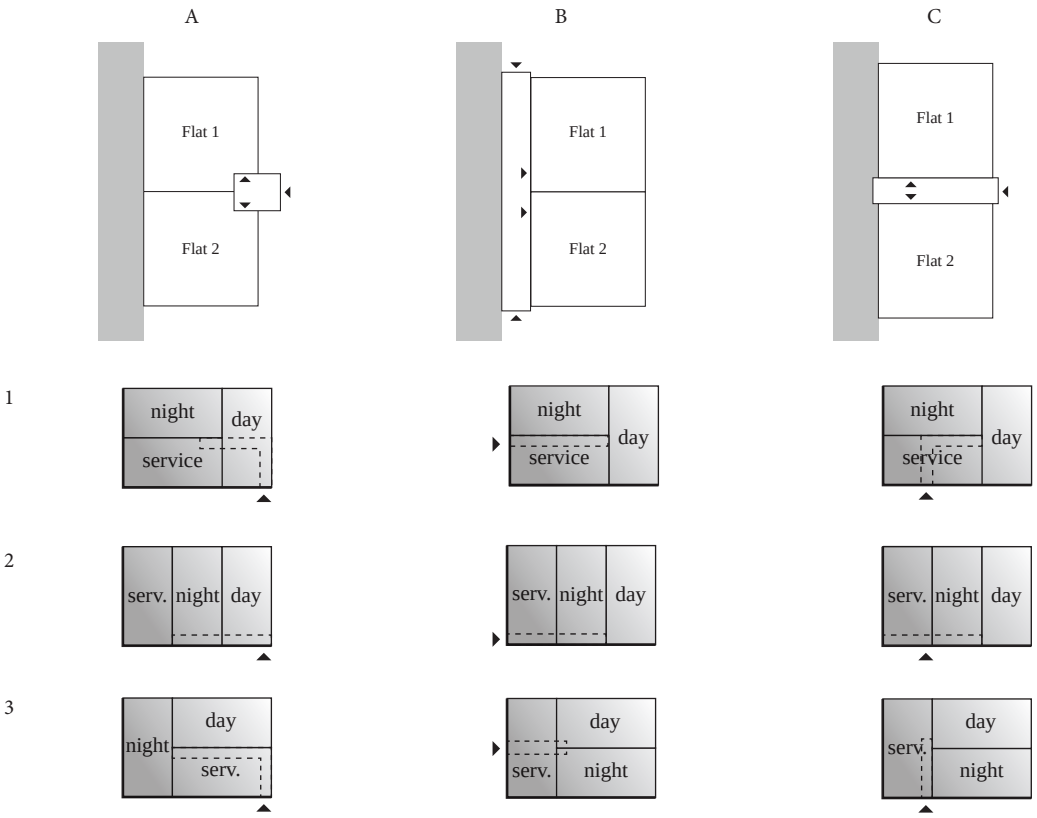
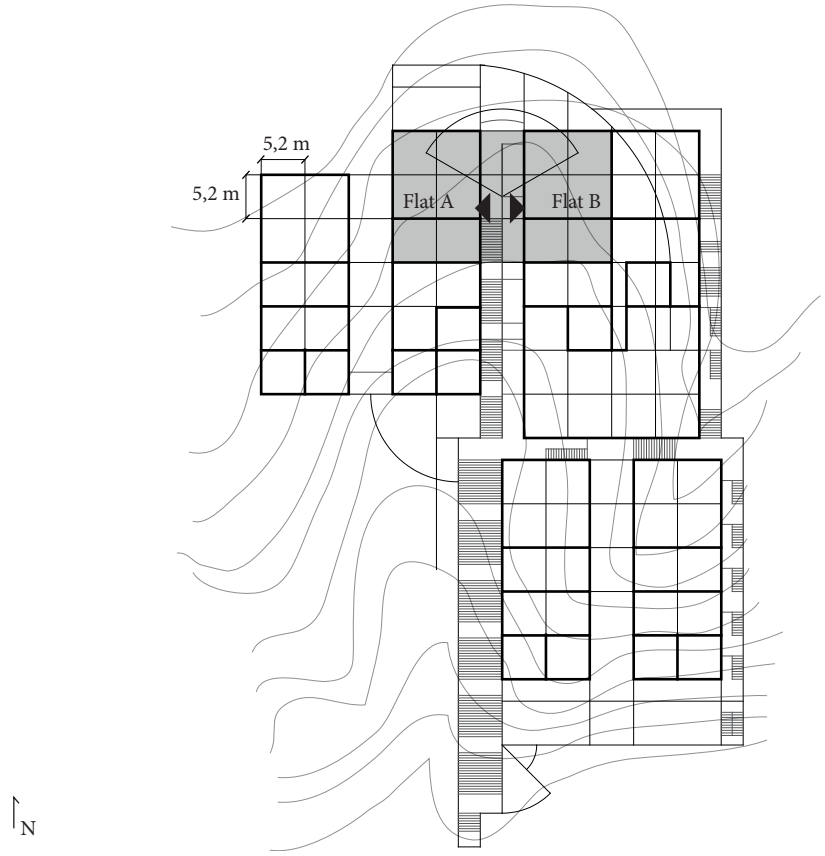


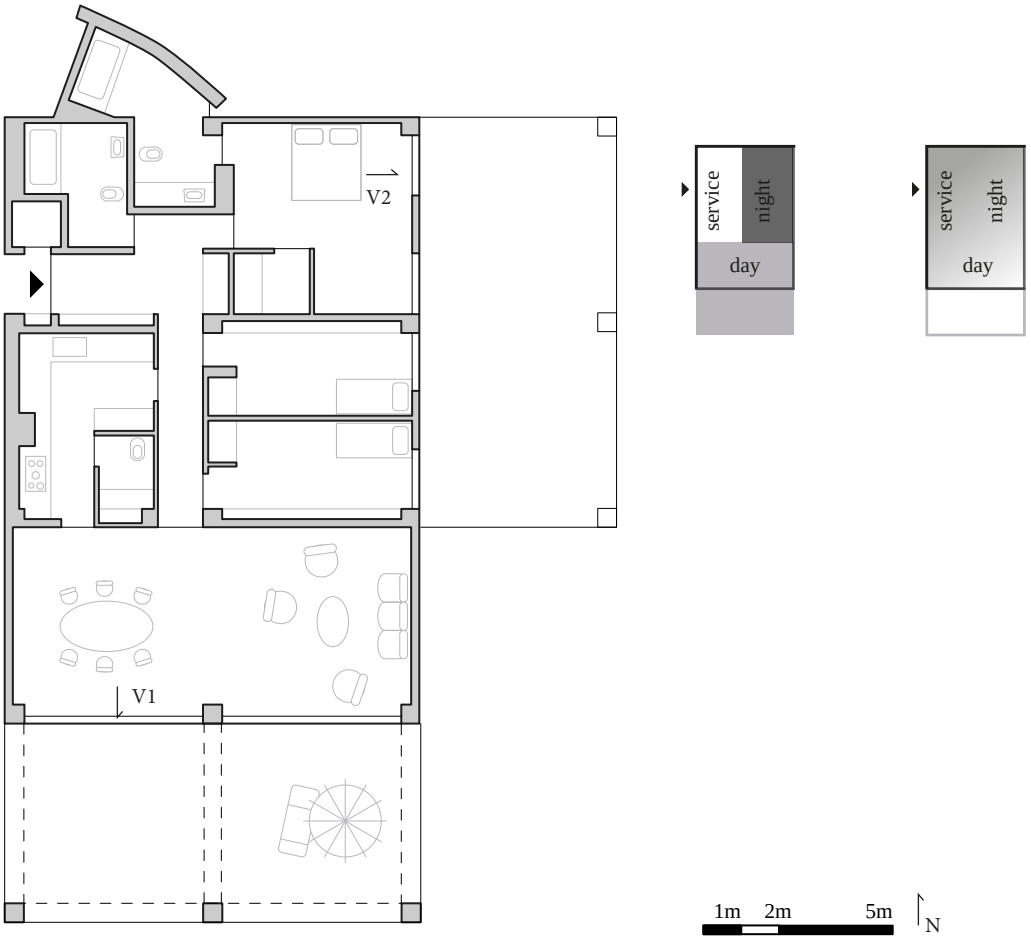
Diagram of distribution options.
Considering the presence of a mountain on one side, the diagrams show different options of building layout according to the distribution paths (columns A, B, and C) and propose some internal layouts that respect it (raw 1, 2, and 3). A grey gradient shows the general light level of the internal flat space considering two blind sides in the bottom-left corner.

The diagrams above show how the distribution path of a building with a blind side can be organized and how this choice influence the internal organization of the dwelling spaces. In order to be able to put the service area (toilet, bathroom, cloakroom, storage, etc.) in the darkest space of the house, while considering to organize the locales mostly used during the day (living room, dining room, and terrace) in the brightest area, the option B and C seem to be the most appropriate. Moreover, with the aim of giving space to more than one bedroom, the options B1 and C1 are the only one suitable.
The drawing in the next page focus again the attention on the actual realization of Rokko Housing II. The diagrammatic plan of the building highlights the two top flats of the central core of building II, but the same organization of the distribution paths is followed at all floors. Looking at the apartment scale, we can notice that Ando realized the building applying the solution here named C1 (see example plan of the right apartment at the second to last floor).
Clearly, the organization of the flat is done according to the use in time of the dwelling spaces, separating day activities from night ones and showing an attention to the contemporary use of the house while giving adequate storage space and a greater amount of privacy to the master bedroom thanks to its private access to a bathroom and the location on the top right corner, far from the main internal fluxes and noises. The authenticity of distribution choices is therefore obtained because they emphasize the sensuousness of the spaces (as described in the chapter *Sensuousness and Comfort*) and they respect the local environment (presence of the mountain and orientation of the spaces) both at the building scale and at the apartment level.
In conclusion, we can say that distribution strategies are strictly related to the disposition principle largely described through Loos case study, instrument to create the internal journey of the dwelling experience, linking indissolubly sensuousness, comfort, and authenticity.
But as we stated before, the sensuousness and authenticity of Ando spaces especially belongs from their particular vocation to encourage inhabitants in the use of outdoor spaces. In the next pages the

analysis will focus on the technical strategies that allow the architect to do this.



Diagrammatic plan of Rokko Housing complex II. The diagram shows the general organization of the complex in plan and underlines the position of two flats in order to study the distribution paths of the building focusing on a simple example.



Example plan of Rokko Housing complex II. The drawings show how the distribution choices of the architect are in line with internal layout needs. The entrance is located in the darkest area, where the services are concentrated; night and day activities are strongly separated and have an increasing amount of light coming in through the windows, that face East in the bedrooms and South in the living areas.

From the apartment plan is possible to notice how the organization of the dwelling spaces is made in such a way that the living area is expanded to the outside and doubled in its size thanks to the provision of a large terrace of around 54 m^2 that faces to the city of Kobe.
Ando in fact expects that life in the diverse units will concentrate around the open space, in a constant communication between users and landscape that respects Kaplan's indications (1992; 1995).
This relationship is emphasized not only in the living room, but also in the bedrooms. In this case although the view to the outside is not toward the city, but to the trees that surround the complex. In this way, the view is strictly related to the sensuousness of the indoor spaces and emphasizes the different gesture of the locales: in the bedroom, the verdant outdoor environment suggests, according to Kaplan understanding, relax and peace; in the living room the artificial landscape links directly with the active and urban life, but the distance provided by the hight transforms it in a beautiful picture to look at, maintaining as a constant the feeling of peacefulness that should characterize being home. The view toward outside becomes indeed a detail of architecture, with its colours and components (for colours relevance, see also Müller House case study and Appendix 1) taking part in the sensuousness construction of the space as a whole. In order to better understand this principle, two sketches show the view options and their different sensuousness.

V1

V2

Sketches of the views to the outside. The sketch on the top represents the view from the living room toward the terrace and the city; the sketch on the bottom represents the view from the master bedroom toward the verdant landscape surrounding the building.

Since for Ando the privacy of the home space is fundamental as much as the link between indoor and outdoor spaces, at the building scale the outdoor organization strategies reflect these needs and propose a solution coherent with the natural configuration of the environment around the architecture. Once again, a general understanding of the problem has been done giving examples of possible layouts in order to give inhabitants of a building an outdoor space.
The next diagram shows how it is possible to give the same amount of outdoor space to people living in a building or a cluster of flats giving shape to very different gestures of the open area.
On one extreme, architect could decide to merge the areas of gardens or terraces and create a courtyard in common-use, in this sense here defined public. On the other side, it is possible to design private areas that don't communicate with the others and are perceived by inhabitants as part of their homes because they have the exclusive access to them and they are not visually connected to other dwellings, in this sense defined private.

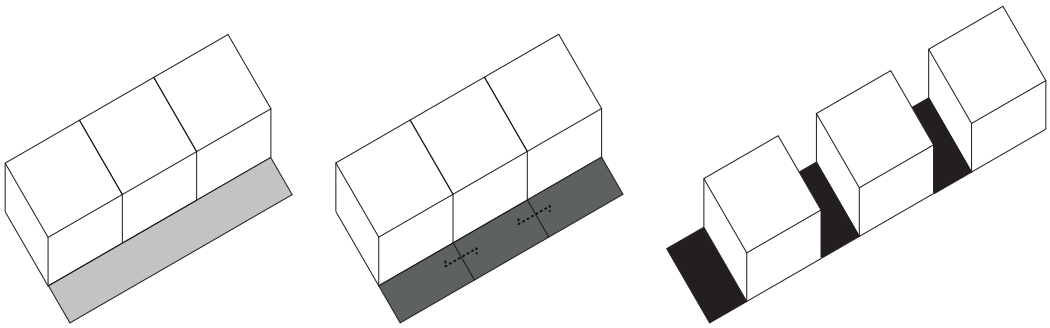
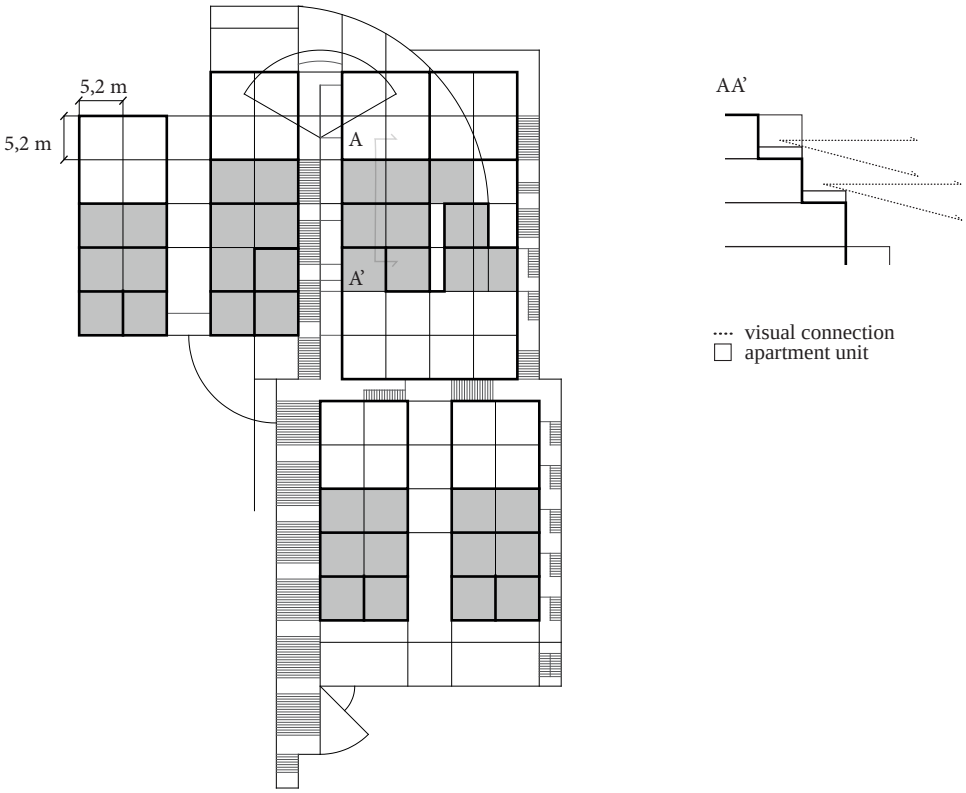


Diagram of outdoor space organization options.

Ando chooses the last option, and profit of the natural slope of the mountain in order to separate the terraces of each flat, that are the rooftop of the flat behind. Looking again to a diagrammatic plan of the complex II, it is possible to notice how this strategy helps to condense the building and reduce its extension in plan. Comparing the plan with the diagram C at page 66 it is clear that the apparent continuity of the open spaces is dissolved thanks to the difference of hight.



Diagrammatic plan and section of terracces organization in Rokko Housing complex II.

How to entrench the building in the realm?

In conclusion, it is possible to say that Ando created an authentic architecture because he merged traditional architectural strategies with the peculiar characteristics of the place in which he built the dwelling complex. The sensuousness of the spaces, related to formal expression of the building, is here enriched by the studies on the existent environment (both cultural and physical). In this way, architecture and pre-existent landscape are inseparable and constitute a new landscape that permanently stays on the ground, because it is rooted in it.

Reflections

However, the theme of permanence is here treated just partly because the architect does not consider changes that are typical of the family configuration: changes on members number, and changes in the life-style linked to the age of the members. In order to reflect among these, the next chapter will focus on the relation between permanence and functionality of the space.
Thinking about future project, and especially considering the dwelling design that will be approached in the second part of this thesis, Ando answers to the theme of authenticity are a precious source of inspiration. Nevertheless, it is important to underline differences between Rokko mountain context and Milan urban and flat environment that will not allow a direct application of complex II formal solutions to the new design. On the opposite, strategies to reach a particular indoor sensuousness thanks to outward views and distribution paths organization could be used.

3

FUNCTIONALITY AND FLEXIBILITY

What makes the identification place-identity
last longer?

In the following chapter, the discourse on the changeability of society and house uses together with the failures of modern buildings in the contemporary society previously anticipated will be deepened. This will bring to the analysis of the methods that architects have to guarantee a certain **adaptability of the home space according to changes of lifestyle** in order to extend the buildings' time of permanence in the realm without deserting the concept of authenticity. Since authenticity has been defined in the previous chapter as the architectural property of being rooted and sensuous, the present chapter will **introduce the concept of flexibility in tectonic architecture reflecting on the existing link between functionality, permanence, and future authenticity**.
Finally, the changes on the architectural practice of the last century will be briefly described and will pose **questions about the role that architects should cover**.

CHAPTER QUERIES

How is the concept of flexibility linked to the one of permanence in architecture?
How should functionality adapt in time?
How should clients be involved in the dwelling design?
In which measure?

As for the previous chapters, in the next page a diagram synthetically visualizes the structure of the following chapter. The diagram builds upon the one presented at page 13 and associates to each keyword a logo that belongs from the Glossary. In this way it is a tool for readers to orient the understanding of the chapter contents anticipating them and showing the connections between themes.

Chapter structure

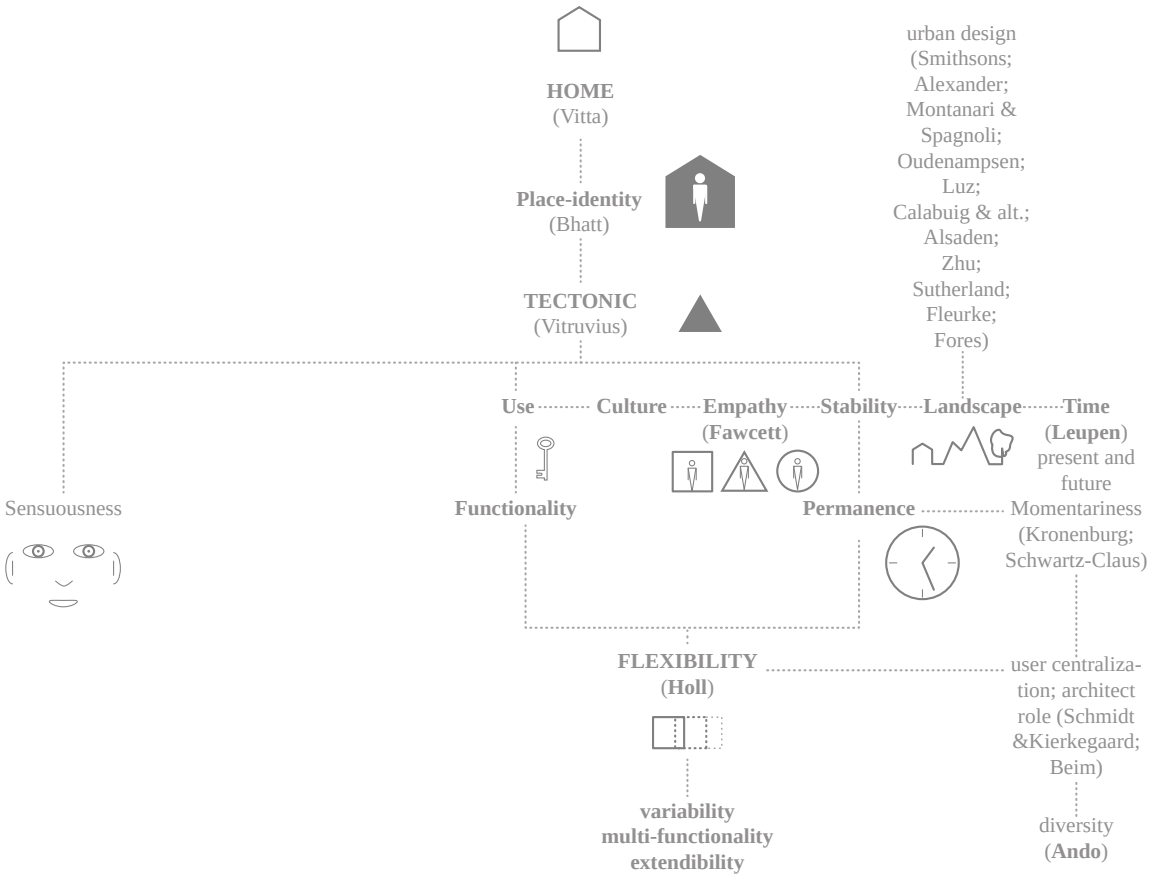


Diagram of the organization of the research related to the theme of Functionality and Flexibility. In bold, key-words and main authors. Logos refer to the Glossary.

As largely described in the previous chapters, the changes in all the fields of post-modern society deeply influenced the city life and the dwelling experience, arriving to modify individual and social habits.
Resuming the situation, in 2009 Montanari and Spagnoli notice that, in general, lifestyle changes act on:

- Internal relationships of the dwelling space, influenced by the changes of house-keeping, familiar hierarchy, use of time and spaces by the inhabitants, dimensions of the space;
- Relationship between public and private spaces, indoor and outdoor, due to the extension of the dwelling space to the outside[1].

Moreover, we already underlined how this changes are not definitive, but on the contrary they are destined to constantly transform.
Other important consideration, as Anne Beim notices in her *Tectonic Visions in Architecture* (2004), is that "in most building projects, with the possible exception of single-family housing, the ultimate decision-maker - the client - is no longer just one person with a clear vision of needs that are to be fulfilled in the final project. The traditional set up with a single client has been replaced by a building committee that is often supplemented with some sort of client consultant, increasing the number of potential decision-makers". The new organization of the design process necessarily transformed the role of architects, which are often relegated to the role of a consultants that mainly deal with "issues of aesthetic appearance". Architects risk in this way to do not be any longer the professionals that produce innovation for architectural design and construction practice, but, following the worst Modernist practice, they simply solve space questions homologating locales and pursuing general standards in order to satisfy undefined users[2].
Even if already readable in Teige's analysis and Loos architecture, described in the previous chapter, t**he global understanding of urban life as a function of the relationships among its inhabitants** started after the Second World War, when the countries of central Europe were recovering and aimed for a welfare state that required new programs for a growing middle class (Calabuig et al. 2013). Hence the focus point of many architectural researches became in all Europe **the importance of centring people in architecture**, finding a way to build a space in which everybody could feel the sense of property and identity.
Referring once again to Maurizio Vitta (2008), we can describe two main design attitudes to the theme:

- The creation by architects of a **neutral built frame open to users' personalizations**, identifying an approach oriented to the provision of flexibility;
- The creation of an 'hardware' useful at the beginning of the design process to define a **specific dwelling space defined by the architect according to users' wills**, identifying an approach oriented to the provision of diversity.

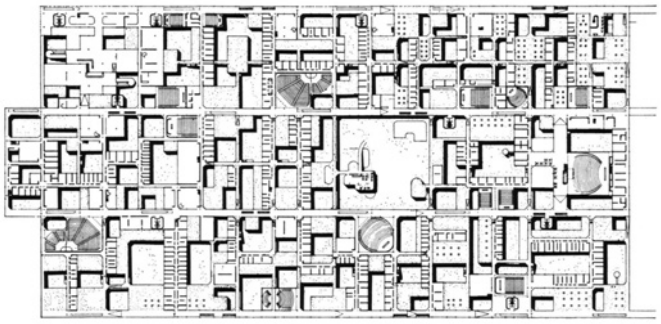
In the next paragraphs, examples of the two approaches will be

Dealing with clients

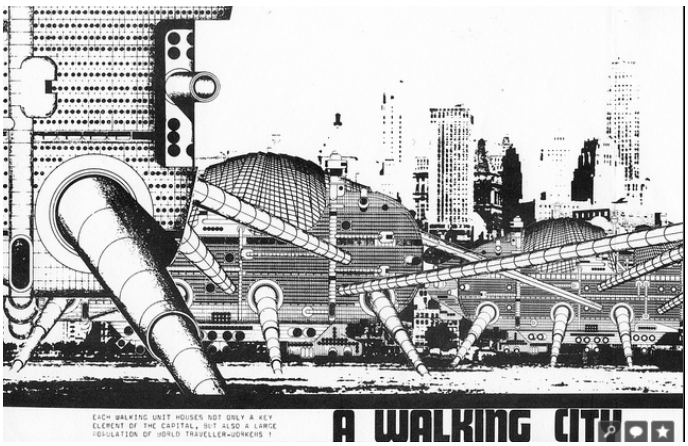
1 As Teige previewed, the collective activities are often moved from the private space of the house to the public spaces of the city (Teige 2002); in this ways, the city becomes integrated part of the dwelling experience intended in its complexity and totality.

2 Poul Henning Kierkegaard and Anne Marie Due Schmidt reflect in their paper *Tectonic transformation - the architect as an agent of change* (2006) about the theme. In their conclusions, architects should release themselves from the formalist role acting as technology developers, experimenting new solutions and promoting changes.

Flexibility: architecture as frame



Indeterminacy, extendibility, and flexibility to allow time changes.
Candilis Josic Woods 1963-74, Berlin Free University plan, manifesto of Mat-building design.



Flexibility as nomadic architecture.
Herron R. 1964, *The Walking City*, collage published in the avant-guarde architecture journal Archigram. The walking city was an idea that proposed building massive mobile robotic structures, with their own intelligence, that could freely move and interconnect with each other when needed. Clearly, the provocative proposal takes into the extreme the theme of flexibility revolutionising both urban and architectural forms in a way that is hardly connectible to cultural and social realm.

given.

The first approach is largely described by Bernard Leupen in his book *Frame and generic space* (2006). Leupen starts from the consideration that a building has an average permanence in time of a century to justify the theory that architects should shape spaces mutable in time in their use, operation, and location: flexible buildings will adapt to changes, will transform instead of restrict functions, and will interact with users instead of inhibit them. He writes: "Flexibility and changeability are the keywords when faced with the unpredictable", which is the future change. Nevertheless, he specifies that buildings have a durable dimensions, meaning that the **architectural project should build a physical structure (permanent and immutable) that defines the boundaries of the allowable variations**.
It is clear at this point that if Critical Regionalism approach, described in the chapter *Permanence and Authenticity*, introduces in architecture the theme of time reflecting on the relation that past traditions and present realm should have on the definition of buildings, the flexibility approach brings the reflection further showing that architecture can (and might) deal with future.
Starting from these considerations, Leupen indicates the mayor failure of Modernist houses as their "deterministic functionalism", useful to solve the immediate problems of the time but unable to adapt to eventual changes, and emphasises: "A contradiction presents itself. **The more precisely we are able to determine the requirements a dwelling must satisfy at its inception, the greater the chance that a discrepancy arises between the dwelling and its use in the future**". In his understanding indeed the only certainty that we have regarding future is that our needs will change. Defining the dwelling space in such a way that present needs are satisfied by the provision of very specialized spaces will mean that in the future we will have in our dwelling a waste of space or a lack of room for other activities.
Agreeing with Leupen, Robert Kronenburg (2007) writes about the possibility of re-thinking the dwelling spaces in order to adapt them to the life-style of inhabitants in time: "For example, consider a house that has been specifically designed to offer changing opportunities to its inhabitants - the option to have peace and seclusion while living in the centre of the city, or to be connected with friends and business colleagues while living in a remote place. It could be a house designed for a single person during the week and for six at the weekend, or a home that you took with you in business trips. Perhaps a building that fits your individual needs now, but one that you can invest in over the course of your life and divide up between your children to give them each a starter home when they need it".
To solve the problem of the discrepancy between present and future uses, Leupen aims for a space that has a specific frame (which defines the permanent space for change) surrounding a generic inside space, left by intention unspecified. To the architects is left the duty to decide what kinds of freedom to enable through the frame so as to make room to the unknown.
To give a practical example of how Leupen's theories could be applied in architecture it is possible to look at Team X research. Based on the post-war realm and against the homologation of the Modern Movement, the group theorized the Mat-design approach[1].
Mat-buildings became visible for the first time with the actualization of the Berlin Free University in Frankfurt of Candilis, Josic and Woods (1963), that Allison Smithson describes in her article

1 For further studies on the theme of Mat-buildings and the relevance of Team X researches in contemporary architecture and urban design, it is possible to read, between the others, the papers of Calabuig, Gomez, and Ramos (2013), Forès (2011), and Zhu (2009).

How to recognize and read Mat-Building. Mainstream architecture as it has developed towards the mat-building (1974)saying: "We perpetuate an environment where some things are central and others are not, without however, any competence for determining which things belong to which category. […] The parts of a system take their identity from system. […] The system will have more than the usual three dimensions. They will include a time dimension. **The system will be sufficiently flexible to permit growth and change within themselves throughout the course of their lives**. The system will remain open in both directions […]. We feel that Web, by which word we mean to designate Stem to the next degree, may provide a way to approach the search for system and, hence, for a true poetic discovery of architecture". Smithson's Web is clearly coincident in the scope with Leupen's frame, defining the boundaries of a systematic flexibility.
In the Berlin Free University we can read the promotion of a generic space defined exclusively by users activities (what Leupen will call **'polyvalent' space**), but we can also find the base for the other two categories of changeable space admitted by Leupen: **the 'alterable'**, which consists in a generic space containing some changeable layers, **and the 'extendible'**, which is a generic space that allows addictions because it is not bordered on all sides.
Between the three categories, the author seems to promote the design of polyvalent or extendible spaces more than alterable ones. The reason is that in his understanding "to design the changeable portion, we need to know something of the expected changes in inhabitation" and the task of predicting how dwellings will be used in distant future is not only impossible, but brings to the design of strategies that solve problems that may never materialize.
Reinforcing the concept of flexibility to the extreme, Kronenburg (2007) rejects permanence in architecture stating: "The ultimate flexible interior may be one that is completely amorphous and transitional; changing shape, colour, lighting level, acoustic and temperature as the inhabitant moves through it - abandoning flat horizontal surfaces and demarcations between hard and soft, warm and cold, wet and dry. A flexible building could be architecture as installation, assembled at the site at a particular time for a particular purpose [...]. It could be a structure that is lightly placed in the landscape of our cities and countryside, rather than founded there, allowing the physical environment to continue around it, subtly and perhaps only temporarily affected by its presence"[2].

If the potential of the flexible approach to the dwelling space, as stated by Vitta, is to allow buildings to perform as social activator and to extend their permanence in time, on the other hand it has the risk, with the promulgation of neutral spaces, to continue the International Style tendency of homologating architecture. This risk has been called by William Fawcett (2011) the problem of **over-provision for flexibility,** which is explained precisely through the example of the Free University of Berlin, collapsed and rebuilt by the 1990s due to its "excessive provision of physical interchangeability".
Nevertheless, Fawcett explains how also the **under-provision for flexibility** can be negative with a view to future growth and change of both buildings and cities, recalling the idea that flexibility is a strategy that has to be pursued in architecture. His theory is that more accurate analyses could avoid mismatches

2 Completing Leupen's study, Kronenburg (2007) resumes in his book the main historical steps that brought architects from the design of static objects to the creation of flexible spaces for dwellings; moreover, Mathias Schwarts-Clauss and Alexander von Vegesack collect in their *Living in motion, Design and architecture for flexible dwelling* (2002) studies and practical examples specifically focused on movable partitions inside the house space.

LEUPEN'S INDICATIONS:

Buildings have to consider time transformations that however are not predictable. Hence architects should reduce their work to the creation of a permanent structure (frame) that allows users transformations in time through:

- Addiction of modules;
- Change of layers;
- Personalization of polyvalent spaces.

The necessity of quantifying flexibility needs

between flexibility investments and actual needs. In this way, **we could pass from environmental flexibility to a "well-defined and quantifiable environmental attribute" of the space based on permanence considerations**. He writes: "In some cases the question 'what is the flexibility for?' can be answered with a list of the relevant activity states". For the author, which applies the Gibbsian approach[1] to the architectural field, understanding the ways in which people can divide in groups is fundamental to build spaces that fit the activities that will take place in it. In the same time, he notices how mathematical analysis predicts that the most probable grouping will have "few very small groups, many quite small groups, and a diminishing number of groups as the size gets larger". Translating this indications to family groups we might say that the largest part of flats should host groups of 2-3 people, few should be designed for singles and a degreasing number of apartments should suit families from 4 to bigger number of members.
Concluding, Fawcett underlines that **an architecture that aims to provide adaptation to future and unknown uses might not count the number of different physical configurations that allows, but might evaluate the doable activity change in comparison with possible activities**. In this way, the long-term value of construction investments may increase.

FAWCETT'S INDICATIONS:

Architecture might include a certain flexibility of the spaces in accordance with possible future uses. The maximum partitions flexibility possible doesn't necessary guarantee the maximum activities flexibility.

Diversity and empathy

The second approach to the issue of user's centralization, promoted by architects as Makoto Sei Watanabe and Tadao Ando, excludes the risk of homologation claiming for **dwelling spaces designed *ad hoc* for the clients** in the moment of the request. **The variety and variability of society is here interpreted as necessity of spatial diversification**, more than spatial changeability. As we saw in the previous chapter with the case study of Rokko Housing by Ando, this attitude to the design process goes directly inside the dwelling reality, asks questions about the actual social, cultural, technological realm and develops from the inhabitants, **refusing predefined models**. In this way, the architectural result will be contextual, authentic and personal; it will strictly serve the single design event. The same Tadao Ando (2007) explains: "Architecture to me is the pursuit of individual solutions under particular circumstances. I design houses in particular with certain individuals in mind, and in any discussion of my design process I must include the role played by my emotions". Flexibility lies in the adaptability of the design program and in the extendibility of the architecture (like in House Koshino, designed by Ando in three phases from 1979 to 2006), while the permanence of the architectural result is guaranteed by its link with the context in which it is placed, both physically and culturally.
In line with Vitta's definition of home as form of our being (see chapter *The contemporary Problem*) and Pallasmaa's understanding of architecture as expression of our temporary vision of the world (see chapter *Sensuousness and Comfort*), Ando seems to suggest that architecture is the formal transcription of personal emotions and perception of reality. This architectural feature is also recognised by Eduard Sekler (1965), that calls the superimposition of our own image and the architectural form as **empathy**. It is my personal claim that empathy might occur in two different phases of the architectural process whether providing flexibility or diversity to the building. First of all, in line with both Ando's example and Fawcett's indications, architects should have an empathetic approach to design in order to 'understand' users and "make visible that intensified kind of experience of reality which is the artist domain" (Sekler 1965). Secondly, the

ANDO'S INDICATIONS:

Architects have to accept the non-universality of their results and concentrate on the singular performance training empathy.
The spaces should suit the diversity of clients and:
- Refuse homologation;
- Reflect society;
- Be linked with nature.

1 J W Gibbs was a physicist that wanted to consider in his studies not one world, but all the possible worlds that are the "possible states" (or microstates) of the system environment giving a limited set of questions.

final users should be able to pathetically recognise them-selves in the space creating the feeling of space-identity described since the first pages of the present essay.

The relation architecture/time

Concluding the reflection on momentariness of society of the present chapter, it is possible to sum up the informations above saying that momentariness can be architecturally interpreted as a need for flexibility or as a need for diversity.
Flexibility is read through the presence of spaces that are polyvalent, alterable or extendible; diversity is read through the presence of diverse and patchy spaces, but highly characterized.
If the first approach on the theme of user's centralization, described as flexible architecture, focuses on the momentariness aspect of society doing a direct translation of the concept in architecture, the second approach, which is here described as architecture that provide diversity, concentrate the efforts of the architect in the creation of spaces that focuses on the theme of permanence in the present time and can be linked with the theme of authenticity defined in the previous chapter. In both case anyway the goal is to create place-identity that wins the time dare.
The two tendencies represent the extremes of the architectural debate: on one side we have an approach that brings architects to a shift from being the only designers to be one of the actors involved in the spatial configuration, on the other side we described an approach that reinforces architects traditional role as social analysts that make decisions for the common health. In between, less radical positions are included and surely the two interpretation are not alternative, but can coexist in the architectural result. The diagram below summarizes the studies done in this chapter.

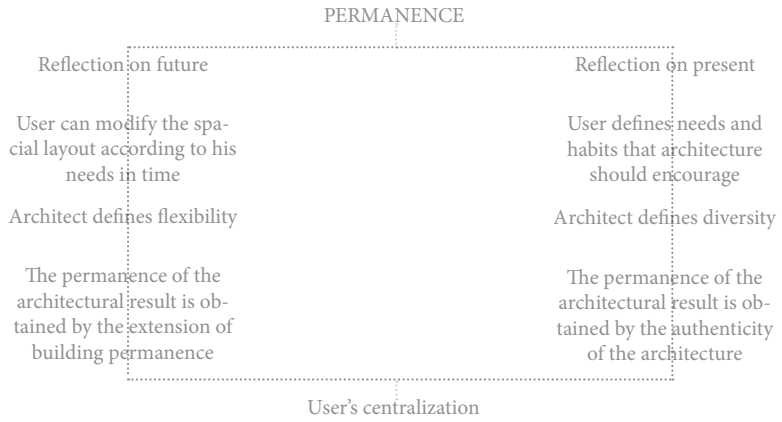
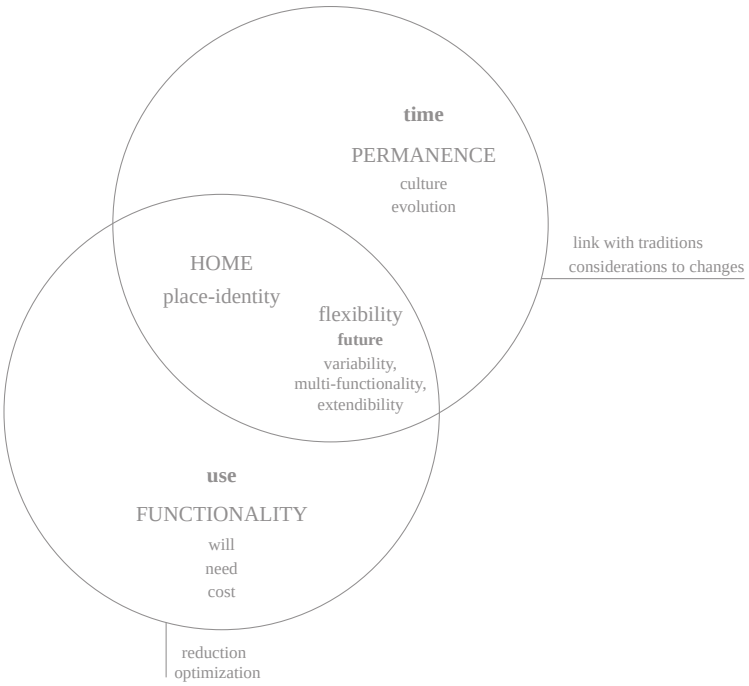


Diagram of design strategies to consider future changes in architecture.

What makes the identification place-identity last longer?

As we can see, the will to include users in the architectural process can bring to different approaches, nevertheless, the one that extend the permanence in time of the building is the approach that accept a certain amount of flexibility in the final design. Consequently, a final diagram expresses the result of the bibliographic review of this chapter underlining how use, time of use and home space are linked by flexibility.



Excluding diversity because considered part of the authenticity debate, in order to understand the position of the architectural design result in relation to user's involvement strategies that relate with the future time, it is possible to analyse the presence of:

- Polyvalent spaces (absence of **details**, as furniture, light etc., that determine the peculiar nature of the space);
- Alterable nature of locales (presence of **movable partitions**);
- Extendibility of the architecture (presence of a **module** that can be reproduced or possibility of the extension of the space toward outside).

Both Müller House and Rokko Housing complex partly include these strategies in the architecture, but without giving a specific thought on their potential. Therefore a new case study will be presented in the next pages showing how the architect dealt with the question of flexibility in the design of a dwelling complex.
As for the other two case studies of the present research, the general scheme of analyses follows Hvejsel one (2012), organizing the informations related to the project under the following paragraphs: **function**, to explain the functional qualities of the architectural gesture; **emotion**, to describe the emotional qualities of the architecture; **realm**, to explain the contextual implications of the architecture; **construct**, to analyse the constructive techniques used; and **principle**, in which it is explained how the architectural gesture is revealed through a constructive principle.
In the particular case of the following case study, the principles investigated will be:

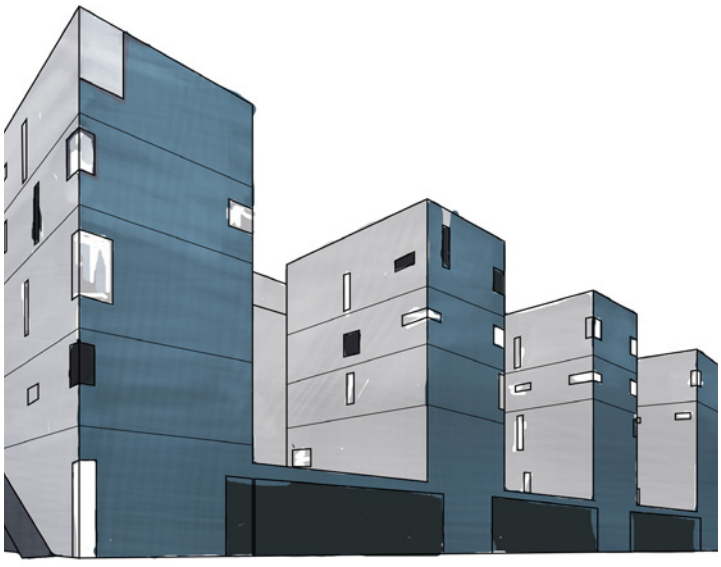
- Variability;
- Multi-functionality;
- Extendibility.

In this way it is possible to understand how the building provides flexibility in the short, medium, and long period. Diagrams are used in order to visualise its characteristics as they have been interpreted.

The relevance of fusing actual functional requirements with future perspective in a dwelling space is clearly defined in the example of Fukuoka Housing, designed by Steven Holl.
The residential building consists in a cluster of apartments and public facilities that respect the social vocation of architecture aimed by architectural critics from the XX century, but includes studies on the private space of the flat that transform the dwelling experience from momentary to permanently linked with the lifestyle requirements of inhabitants. Thus the analysis of the case study given in this section focuses on the understanding of these innovative characteristics of the units that compose the whole, both at the building scale and at the apartment scale, while it will neglect deep studies on those details that have already been largely described in other chapters, like colours, lightness, materials, form, and outdoor organization. In this case, the report will limit to reference to the previous case studies.

HOLL'S ANSWER

Case study: Steven Holl, Fukuoka (1988-91)



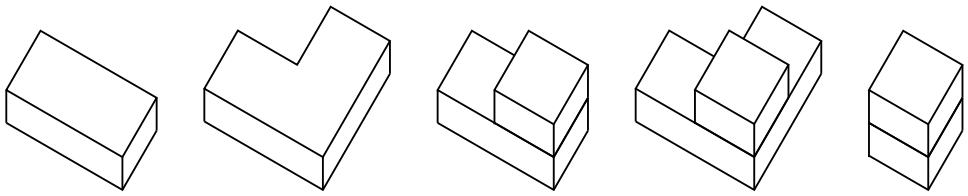
How formal aspects influence the perception of home as space flexible to personal and familiar changes?

Function The building hosts 28 apartments and shops and organizes common facilities in the outdoor public space. Each of the apartments aims to answer to individual needs concerning space, privacy, and identity. The shops at the ground floor guaranty active life around dwellings, while the common facilities encourage a use of the public space by inhabitants and neighbours.

Emotion The gesture expressed by the building conformation is the will of Holl of bringing a sacral dimension into everyday domestic life (Marquez 2003), showing that the architect takes a position in line with Pallasmaa and Ando indications previously described. Holl wants to use architecture as a "vehicle for understanding and experiencing time" (Holl 1012). Hence, the research for an answer to individual requests brings the study on the indoor comfortability further, introducing a reflection on the momentariness of habits that translates in a provision of flexibility of the interior locales.

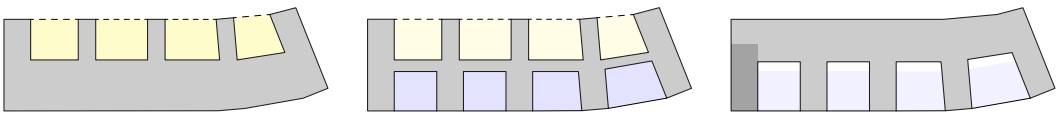
Realm The interiors of the apartments revolve indeed around the concept of 'hinged space,' a development of the multi-use concepts of the traditional Japanese Fusuma, here transformed in a contemporary design strategy based on flexibility studies. Moreover, the building, with its street-aligned shops and intentionally simple facades, is seen as part of a city in its effort to form space rather than become an architecture of object (Marquez 2003). In this way, the approach of Holl gains a position between the architects of the Critical Regionalism promoted by Frampton.

Construct The apartments interlock in section in a complex whole in which each of the 28 apartments is different from the others. Five dwelling typologies are combined in 18 variants: L-shaped plans, I-shaped plans, and double floor apartments divided in simple D (two floors of approximately the same size superposed), DI (like D but with a shift in plan between first and second floor), and DL (with one of the floors larger than the other) layouts.



Diagrammatic axonometry of the apartment typologies in Fukuoka Housing. From the left: I, L, DI, Dl, and D shape.

At the building scale, the architecture is composed by the alternation of full and voids at the different levels. Four voids facing North at the bottom floors, and four voids facing South at the top floors.

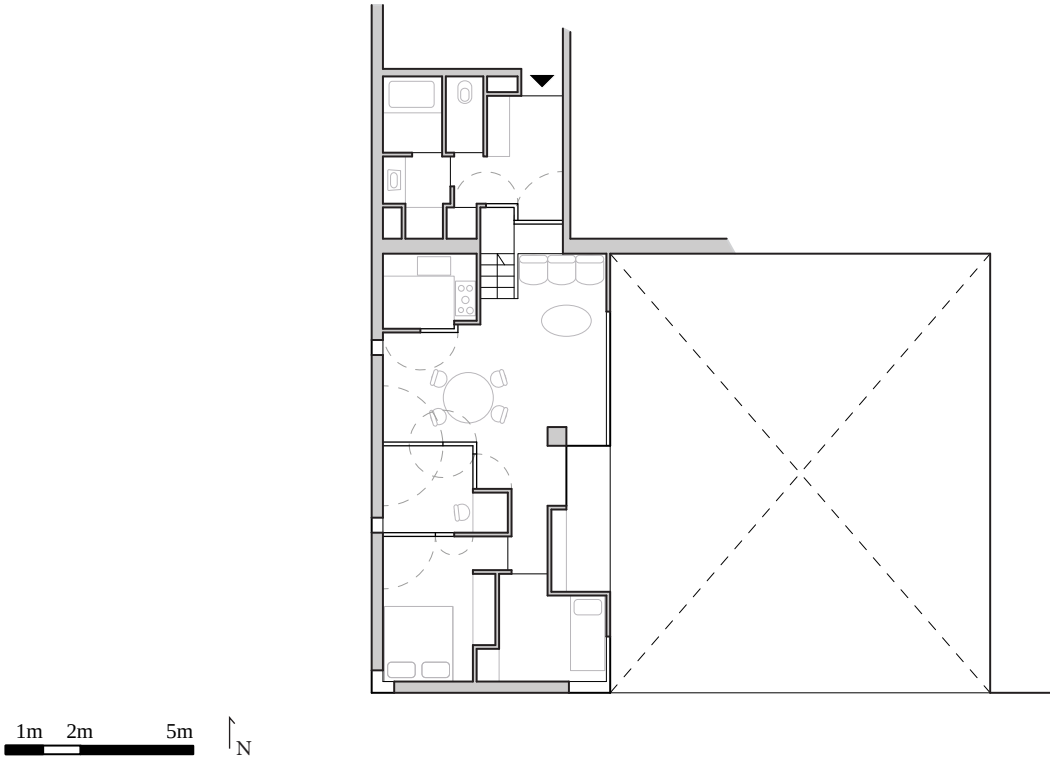


Diagrammatic plans of Fukuoka Housing. From the left: ground floor, first floor, and top floors. In yellow, the space of the playgrounds, in blue, the water pools on the rooftop of the shops. In the last drawing, a dark grey underlines the position of tht apartment that will be further studied in this analysis.

Principle This alternation gives breath to the dwelling units and finds the place for meditative water courts and sheltered playground areas at the ground level. An experiential sense of passage through space is heightened in the three types of access, which allow apartments to have exterior front doors. On the lower passage, views across the water court and through the north voids activate the walk spatially from side to side. Along the north passage one has a sense of suspension with the park in the distance. The top passage has a sky view under direct sunlight.
Focusing again at the apartment level, voids and interlocking section give to each unit from two to four sides of exposure.

Variability As noticed before, the architecture also wants to link building and city, and private and public. The hinged space of the indoor environment is the medium to define this transition public/private in the single flat units. Focusing the attention on one of the apartments is possible to notice how the flexibility of the space allows these gesture (see plan in the next page).
The plan shows that the movable partitions of the apartment are especially concentrated in the living and sleeping areas, where the strategy allows the transformation of the flat from a single to a four beds apartment (see diagrams in the next pages). The partitions that divide the entrance space from the living room, on the other hand, change the perspective from the main door to the dwelling locales. The positioning of the staircase shows that dimension and disposition strategies deeply studied through Loos Müller House have been applied also in this case to extend perceptionally the spaces of

the dwelling experience. Moreover, it is possible to notice how big windows in the living room face the outdoor space above the water pool at the floor below, putting a distance between the flat and the neighbours and inspiring a poetic dwelling experience, in line with Ando indications.
The diagrams and the plans below focus on the movable partition of the flat, showing possible transformations of the space that can accommodate up to four beds, but never changing the general sensuousness and functionality of the single locales. Each space in fact transforms his private or public vocation but in line with the always new function and activity that aims to host.



Plan of a I unit of Fukuoka Housing. Example with all the movable partitions close. From the top: entrance and service area, kitchen, living room and dining area, studio, balcony, double bedroom and single bedroom.

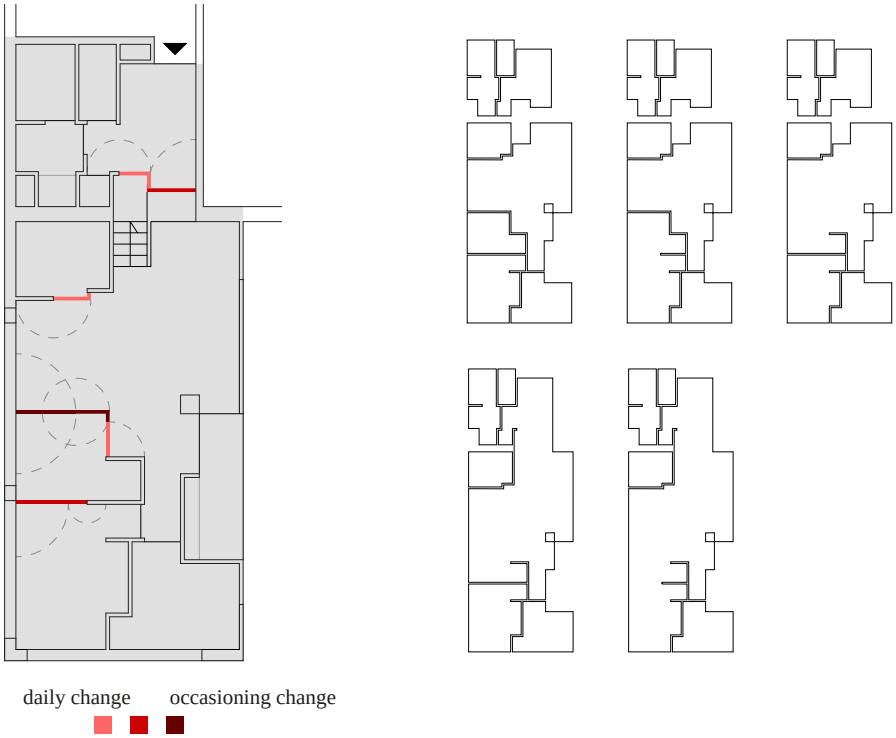


Diagram of the frequency of changes in the disposition of the movable partitions and possible indoor configuration.

Through the diagrams is possible to notice how not all the partitions are supposed to be moved with the same frequency. Some of them indeed have the function of a door, opened and closed several times per day, while others are studied to allow inhabitants in the creation of secondary spaces in order to accommodate family changes: for example the growing up of children that leave the family, or the moving in of elderly parents. Moreover, the easy movability of the hinged partitions allows an

expansion of the living area during the day, reclaiming privacy for bedrooms in the night, useful in case of guests.

Plan of a I unit of Fukuoka Housing. Examples of different interior layouts to host one person or four people.

In order to understand if Holl strategies are in line with Fawcett indications about the necessity to quantify flexibility, a calculation that follows Gibbsian method has been done (see Appendix 3). Without considering guests as an option and referring to a family of 4 members, it is possible to say that in the initial phase of the family status, on which 4 people live together, the flexibility of Holl apartment allows 10 microstates on the 15 possible. On the contrary, imagining to remove al movable partitions and provide the space with a fixed double bedroom plus two singles, the allowed microstates degrease to 6, while thinking about the provision of a fixed triple bedroom plus a single bedroom, the microstates allowed degrease to 4.
Considering all the phases of the family, in which most likely the number of members living together will firstly degrease in time, these differences are even more emphasised: the flexible configuration allows 42 microstates on 47 possible; the option with double bedroom and singles allows 34/47 microstates; and finally the option triple plus single allows 32/47 configurations.
Moreover, it is possible to notice that the fixed configurations would have at least one room empty in 10 cases or 24 cases.
Consequently, Holl choice seems to be the most coherent to issues that consider functionality in the life-span of the apartment that serves a family.
A diagram shows the different use of spaces and movable partition according to the number of members living together.

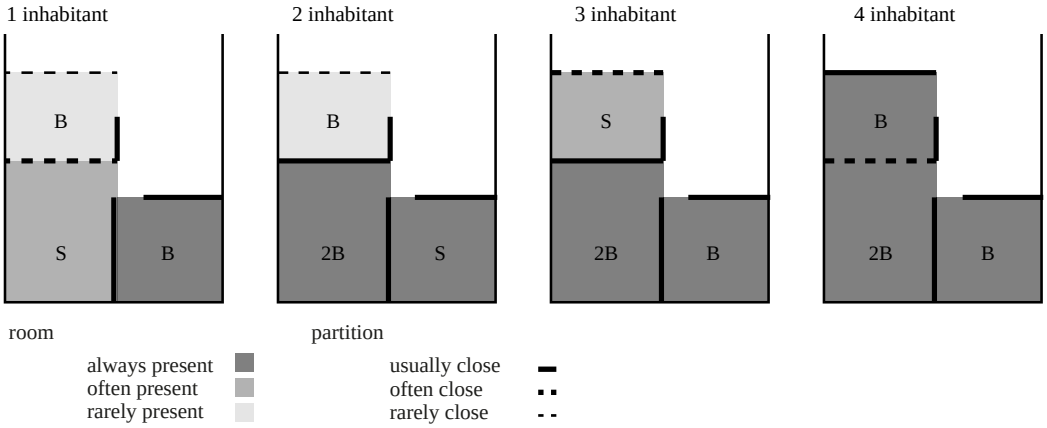


Diagram of the private spaces organization in a flat of Fukuoka Housing. The drawing shows the different internal layout that the flat can assume according to different number of inhabitants. B means bedroom, 2B means double bedroom, and S means studio.

Multi-functionality

Clearly, the modifications on the internal layout are guaranteed by the polyvalent nature of the dwelling space, that doesn't require a particular supply of appliances in living or sleeping areas.
The concentration in nucleus of polyvalent and characterized areas allows the application of alterable partitions. In this way the reflection of Loos and Ando on distribution and disposition of the locales gains a new importance. A further reflection can be done saying that Loos living room in Müller house is an example of polyvalent space, since the definition of the space through materials, textures, etc. don't exclude subdivisions of the locale in under areas.
Just in the same way, collecting the sleeping areas in the dark spaces and opening the day activities to the outdoor, Ando create a polyvalent area that consists in the ensemble of living room, dining space and terrace. Both the previous examples thus present flexible characteristics.

Diagram of the spacial organization in a flat of Fukuoka Housing. The drawing simplifies the internal layout of the flat and underlines the position of characterized locales and multi-functional ones. T means toilet and bathroom, E indicates the entrance area, K locates the kitchen, L locates the living area, B means bedroom.

Extendibility

Finally, at the building level we can read, as in Ando Rokko complex, the repetition of a module. This principle, applied to the discussion on permanence and functionality of the building, can be read as the opportunity to replay the module and extend the building, creating a type repeatable in time. Nevertheless, this strategy is not here seen as a real potential, since the apartment stays closed between the walls that are its boundaries. On the contrary, this possibility of extension is emphasized in Ando dwelling spaces through the cancellation of the borders between indoor and outdoor apartment areas.

What makes the identification place-identity last longer?

Coming back on the theme of permanence, focus of this chapter of the theses, it is possible to give a further reflection on the issue of architectural stability. Steven Holl himself explains in 2012 his conception of time in architecture, explaining that Time is composed of several times, inseparable one from the others. He lists seven kinds of architectural time: diurnal time, seasonal time, linear time (which corresponds to the historical time), local site time (compared with the global time), duration of conception and construction, experiential time, and physical duration.
We can probably conclude that Fukuoka Housing, with its flexible strategies, concentrates the designing strategies on the experiential time and the physical duration, where the seasonal time in this case becomes the time of the phases of the family, more than the sequence of summers and winters alone. The present time of the home space has in this way the potential to be extended to the future. Differently Loos indoor strategies concentrates on the personal diurnal experiences of architecture perpetuating present time. Finally Ando architecture seems to focus on seasonal and local times emphasizing differences, but in the same time blurring boundaries between past and present.

Reflections

Thinking about future projects, and especially considering the dwelling design that will be approached in the second part of this thesis, all three indications will be taken into account in order to find an architectural form that answers to present issue, but linking them with both past and future times.
Considering the analysis of critical points of view and case studies finished, the next section of the report gives a synthesis of the studies done and opens to future perspectives for the design of contemporary dwellings that aims to a tectonic approach.

SYNTHESIS

A new definition of tectonic

The present thesis started from the collection of considerations by several contemporary critics about the actual situation of dwelling architecture in dense cities, underlining that the functional model promoted by Modernists in the XX century, highly standardised and often homologating, is living nowadays a crisis that belongs from cultural, ideological and social changes:

- New family definition;
- Momentariness and fluidity of society structure;
- Massive introduction of technological appliances.

These changes require an adaptation of the dwelling typologies, divided in Teige's studies (2002) in the two categories of 'primitive dwelling' and 'differentiated dwelling' (see chapter *Sensuousness and Comfort* page 42), not only in dense cities, but in all environments. In the contemporary architectural debate, those changes brought architects to a reflection on the concept of place-identity and on the influence of body habits, memory, and tradition in the perception of dwelling spaces by users; but they also brought to a reconsideration of the relationship between building and nature and to researches on ways to extend the permanence in time of buildings thanks to their ability to adapt to possible future changes linked to the environment or to the inhabitants life-style. Consequently in the thesis the term dwelling doesn't simply indicate a house, a flat, an apartment or any other housing typology, but it implicitly refers to the ways of use of those spaces, the lifestyle, the habits, and the culture of their inhabitants.

For these reasons, the present report gave a new interpretation of the Vitruvian triad of *Venustas*, *Utilitas*, and *Firmitas*, oriented to the description of a good architecture, defining the relationship Sensuousness-Functionality-Permanence (page 33).

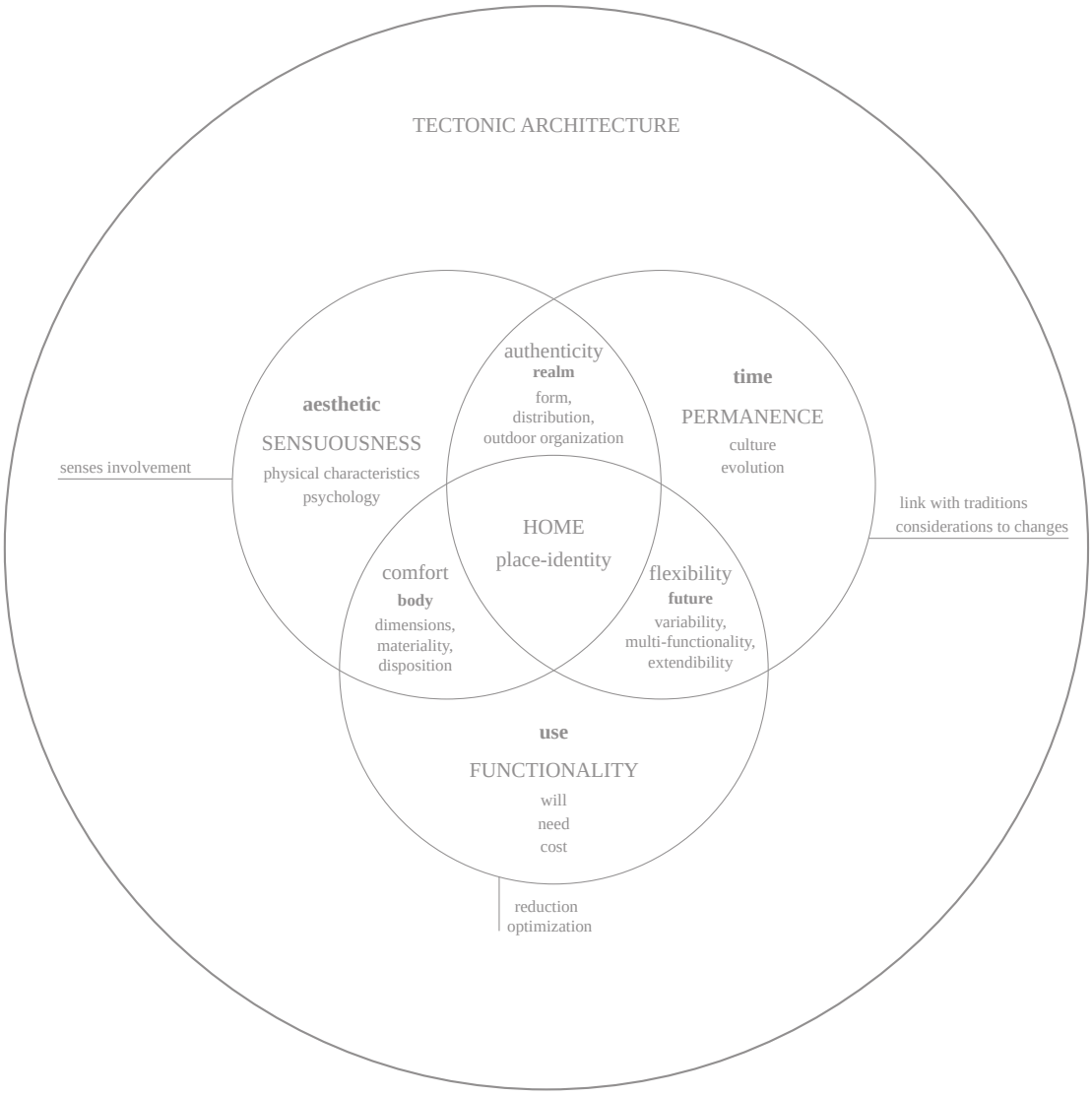


Diagram of the tectonic approach oriented to the creation of homes as place-identity. First visualization.

This relationship should determine a contemporary tectonic design of dwellings that differs from the traditional understanding of tectonics as the result of an architectural approach that integrates structural, functional, and aesthetic considerations because it introduces more clearly in the architectural debate the dimensions of body and time.
As stated since the *Introduction* of the present essay indeed the research of aesthetic value has been often translated in the architectural practice into the realization of buildings as formal exercises, far to embody "spiritual essence", but oriented to satisfy vision alone (Pallasmaa 1996). On the other hand it is my claim that introducing the concept of Sensuousness in the tectonic definition designers are more clearly guided toward the research of a simultaneous involvement of all senses in the creation of the architectural experience. In this way, they will respect and encourage the human nature of collecting information through a full body participation (Pallasmaa 1994 & Dieschinger 2000), arriving at involving users' mind through changes in material, temperature, scent, and others (Cranz in Bhatt 2013).
Similarly, the translation of *Firmitas* as Stability has been considered vague. The term indeed is often interpreted as structural stability, but in the present thesis I extended the meaning of stability defining it as the property of the building to endure in time. Thus I proposed to change the translation of *Firmitas* in Permanence. To chase permanence in architecture indeed is not sufficient to create stable structures, but is also necessary to reflect on the destiny of the architecture (see chapter *Functionality and Flexibility*) and on the meaning that it could have for users (see chapter *Permanence and Authenticity*) in a dialogue between past, present, and future realm.

Acknowledging that the dwelling space is defined both physically and psychologically by users, the bibliographic review of this part of the thesis aimed to find design strategies that allow inhabitants of dense environments to identify themselves with the home-space.
In order to answer, queries linked to the concept of comfort, authenticity, and flexibility of the space have been given, determining that:

What makes the indoor space comfortable?

- Comfort is perceived when the space is sensuous and functional, meaning that architecture should involve the whole human body in the creation of the indoor experience and think about the use of each space in order to suit users.

How to entrench the building in the realm?

- The building can be entrenched in the realm both physically and culturally through a connection with the pre-existing landscape and a link between past constructive traditions and innovation. In this way, the architecture will become authentic and will communicate sensuousness and permanence.

What makes the identification place-identity last longer?

- When looking for dwelling spaces that resist to time changes flexibility might be chased, putting into relation functionality and permanence of the space.

The dwelling space that is comfortable, authentic, and flexible is most likely perceived by users as home, the place-identity.

The relevance of the parameters

How formal aspects influence the perception of home?

A case study collection helped to verify which are the parameters that architects can control while aiming for a tectonic dwelling design. Point by point, we can summarize the parameters considered fundamental in the construction of home:

- Comfort is obtained through a control of **dimensions, materials, disposition, lightness, and noise level of the indoor locales** (as shown by Loos in Müller House, which applies the Raumplan theory, pages 50-57);
- Authenticity is reachable through a study on **form, distribution paths, and organization of the outdoor spaces** at both building scale and apartment scale (as shown by Ando in Rokko Housing complex II, which applies the indications given by the Critical Regionalism movement, pages 72-78);
- Flexibility should consider strategies of **adaptability in the short, middle, and long term** of the dwelling spaces, positioning **multi-functional areas** and thinking about the **extendibility of the architecture** (as shown by Holl in the hinged spaces of Fukuoka Housing, which balance flexible spaces and inflexible ones, pages 91-95).

Where the bibliographic review allowed the extraction of parameters, the case study analysis showed the ways in which they act and they interconnect each others. In fact their analysis was the opportunity to apply on practical examples the theories developed in the first part of each chapter. Moreover, they gave the space to do experiments on the singular parameters investigated.
In this way, the selected cases give a wide range of solutions from which to take ideas for future designs.

By Loos it was possible to understand that:

- **Dispositional strategies can influence the perception of the dimensions of the singular locales**. For example, a small entrance space before a large one makes the second look bigger.
- **Dispositional strategies are fundamental in the creation of the internal journey** that defines the dwelling experience.
- **Visual connections can expand rooms dimensions and anticipate part of the internal journey** through the dwelling spaces.
- **Dimensions can suggest a particular gesture of the space**. Big space are worth for public gatherings, while looking for privacy small locales perform better because they appear more cosy and intimate.
- Large rooms have a certain freedom of use, while small ones necessarily result more specifically defined in their functionality.
- **Materials are expression of a certain sensuousness of the rooms** and play their role together **with lightness and noise level of the space**.
- The **material texture**, polished or rough, **influences the reflection of light**, determining a certain brightness of the space and **consequently influencing the dimensional perception** of it.
- **Colours** are part of the surfaces and together with cladding texture **influence the light reflection**. In particular, a dark coloured room appears smaller, on the opposite a light coloured one can appear larger.
- **Colours position can guide inhabitants to a certain use of the space**. For example a single colourful wall catches the attention of users, that will concentrate on it as to a painting.
- **Material texture also makes the surfaces soft or hard**, influencing the sensuousness of the locale that can become intimate and warm or cold and austere.
- **Sound reverberation time changes the sensuousness of the space** and consequently its comfortability **and it is firstly linked with room dimensions**. A reverberant room is perceived as 'alive' and warm, on the opposite, a totally absorbent room is defined as dead and perceived as cold. Nevertheless, different states of the sound atmosphere are useful to allow a proper use of the locale regarding music and speech.
- **Materials can be sound reflective or absorbent, determining the final reverberation time** of the sound in a space. Cladding can mitigate or emphasize the sound reverberation time of a room with specific dimensions.

Through the reading of Ando case study it was possible to underline that:

- **The form of the building** (shape and orientation) **defines the way and the measure in which pre-existing landscape is involved in the sensuousness construction of the indoor space**. It is indeed possible to say that a building negates or accepts the landscape through the reading of its formal aspects. Furthermore it is possible to understand if accepting landscape the architecture proposes to leave it as a designing constriction or to involve it in the building of a new landscape as a whole between old and new.
- **Distribution paths should be coherent with formal choices** of the building and can be part of the its shape definition.
- **Distribution and shape of the building can determine the presence of public areas** or also public facilities. In this way, the building complex can allow the use of some spaces by neighbours and other citizens.
- At the apartment level, **distributional paths should ponder on the sensuousness of the space**.
- **Indoor distribution paths determine the disposition of locales**, becoming instrument of the internal journey construction and, consequently, determining the comfortability of the flat.
- **The orientation of the apartment locales influence** their amount of daylight, suggesting different **uses** of them. For example, a completely dark room will be used as service area, while a locale facing South will most likely host day activities.
- **The concentration of activities in nucleus** according to the time of use and the daylight requirements for the activities that they host **facilitates the home functionality and comfortability**.
- Choices on **the organization of the outdoor space can influence the indoor sensuousness** of locales.
- A proper positioning of **the outdoor areas** in relation with the indoor ones **can visually and perceptionally extend the dwelling space** toward outside.
- **The view toward outside can become an architectural detail** that influence the sensuousness of the dwelling experience. In particular, a verdant view is relaxing, but a urban landscape can recall the dynamic vocation of the living areas and become attractive when a buffer divides apartment inhabitants and other citizens.
- **The contrast between a rigid grid and the soft movement of natural landscape** can in the first place **emphasize the human presence in the space**, also it can **help visitors to read the landscape** movement.

Finally, the example of Holl underlined that:

- **Short term flexibility permits to reduce space waste** in the dwelling.
- Adaptability of the indoor spaces through **movable partitions allows changes in the indoor conformation and lodging of sporadic events**. For example the strategy can provide room for guests only when needed.
- **Middle term flexibility guarantees home for family structure changes** (children growing up, parents separation, elders moving in, etc.).
- **Movable partitions can divide the apartment locales in order to add or remove private rooms** according to changes in the number of family members living in the same flat.
- **The adaptability of the spaces is guaranteed by the condensation of multi-functional areas against very characterized ones**. For example the service spaces of bathrooms cannot be placed between two bedrooms that preview to be eventually merged into one locale without permanently dividing the space in two areas.
- **Dispositional strategies are permanently linked with the allowed flexibility** of the space.
- **Long term flexibility previews the possibility of extending or reduce building and apartment unit in line with new urban or family requirements**.
- The extendibility of the spaces is given not only through movable partitions, but also through **the presence of modules that can be reproduced and the cancellation of boundaries between different spaces**. For example, the presence of large windows deletes the borders between inside and outside creating a continuum that enlarges the locale dimensions.
- It is necessary to **quantify flexibility in line with possible uses of the dwelling space in order to minimize design efforts and optimize the indoor functionality**.
- **The locales that in a flat are most likely prone to changes are bedrooms and living areas**, including dining room and studio.

In conclusion we can see that if the goal is to design tectonic spaces it will be not possible to investigate one parameter without involving the others. Hence a better visualization of the tectonic approach to dwellings will be given by the following diagram, in which sensuousness, functionality, and permanence are reached through the application of all strategies concerning comfort, authenticity, and flexibility: sense involvement, optimization, reduction, link with traditions, and consideration to changes.

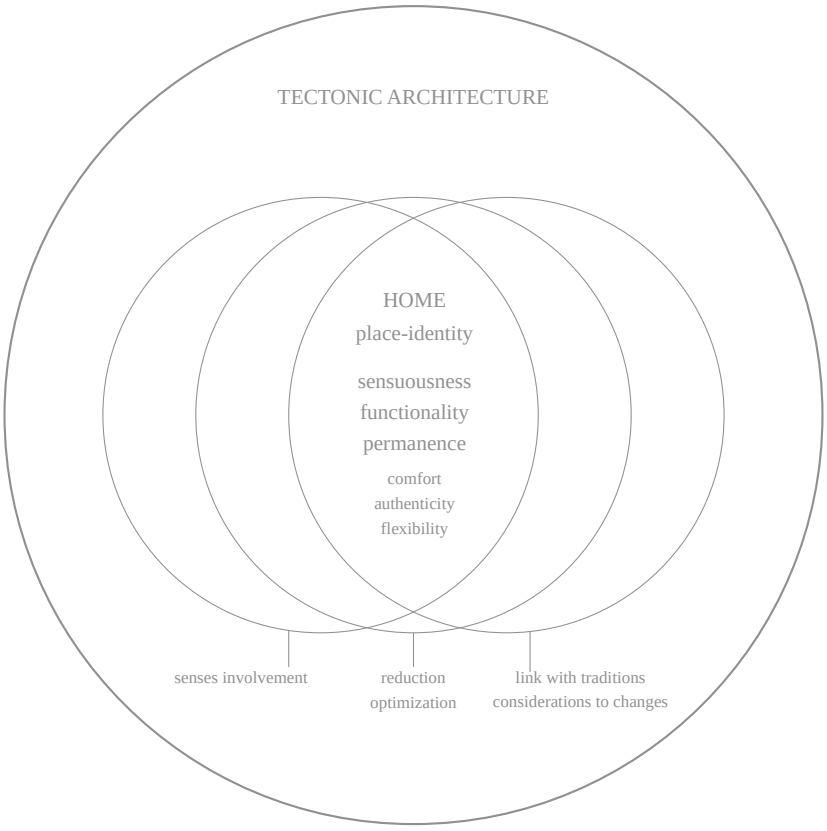


Diagram of the tectonic approach oriented to the creation of homes as place-identity. Final visualization.

Thinking about the context of Milan, surrounded by verdant areas, but densely urbanized, the strategies to design a contemporary tectonic residential complex here collected are precious indications. While Loos gives us a broad amount of examples on how to realize a comfortable indoor space that considers dimensions, tactility of the surfaces, colours, and disposition in the creation of a synaesthetic dwelling experience, Holl starts including a larger dimension in the tectonic design, speaking not only about strategies to modify the flat according to momentary needs, but also including the building scale into the analysis. Finally, Ando completes the frame asking for architectures that examines the landscape scale.
It seems clear to me at this point that the project of future dwelling complex that aims to the creation of tectonic architecture should follow the design scheme by scale visualized below.

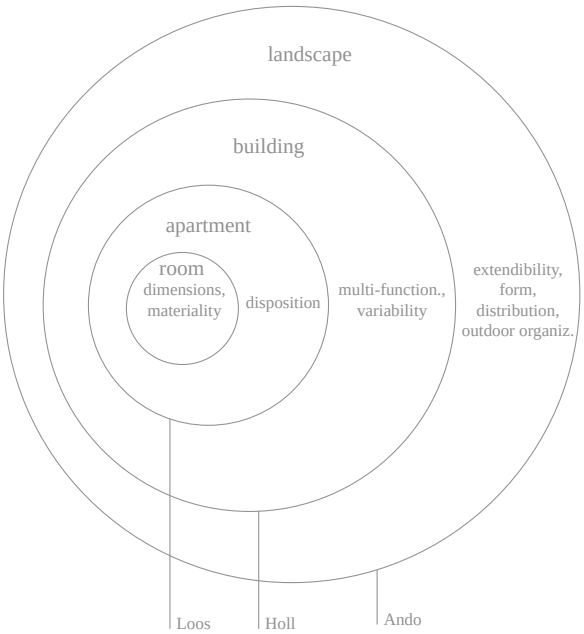


Diagram of the approach by scale to the design of Home as place-identity with references to the architects that are considered in this thesis as the main references to each design level.

PART 2

DESIGNING FOR THE FUTURE

This Master thesis investigates the theme of dwelling in the contemporary city starting from the question: **how to design an apartment as a frame in which everyone (or each of us) can define his home?**

This section of the report contains a project development in Ronchetto S/N, area at the border of Milan. The choice of the project area belongs from both a personal interest, since Milan is my natal city, and from the fact that Milan hosts the International Exposition 2015, event that stimulated in the last years big transformations of the urban environment, including reflections on the theme of 'living'. In particular for the area of Ronchetto Sul Naviglio the Municipality of Milan has a project of densification and integration between a park and new dwellings that I decided to take as opportunity to develop my personal design.

The project builds upon the theoretical research made in the first section of the present thesis and gives a possible tectonic solution to the question of dwellings in contemporary cities. Hence, if the theoretical research gave a general understanding of the problem and built a new interpretation of tectonics as the architecture that answers to the needs of sensuousness, functionality and permanence of the built space, the project will put in practice what theorized answering to the query: **how to apply the theory to the practice of a project for a new dwelling complex in the area of Ronchetto S/N, at the borders of Milan?**

In order to do it, **the project area is first analysed in its existing condition** at a landscape and urban scale. As stated before the understanding of the existing conditions is indeed fundamental for the creation of authentic spaces and will be used as starting point for the design of a new urban complex (see chapter *The Site*). **Thus the project interprets the existing landscape and rebuild it in a new way** (in line with the theories of Critical Regionalism and Nordic architecture largely described in the previous chapter *Permanence and Authenticity*) in order to integrate old and new, but also natural and urban landscape. **Finally, the project approaches the building and apartment scale proposing a design that belongs from Ando, Holl and Loos architectures**, previously analysed, and integrating the concepts of comfortability and flexibility of the space.

The report is organized in such a way that the reader is guided through all the analytical and design processes before they are presented with the final results and presentation drawings (see chapter *Design Presentation*).

THE SITE

What is the realm in which the project
will be build?

This section of the Thesis is devoted to present to readers the project area.
Therefore it collects all the analytic informations that are useful to have a general overview in the first place on Milan, and secondly on the specific area of Ronchetto S/N.

Understanding the city

The report users will find here data on the geographical position of the city of Milan, as well as an summarize of the historical steps that brought it to be the second Italian city after Rome, the capital. For what concerns the geographical characteristics of Milan, it will be possible to read the average climatic changes that the city has during the year, which will be useful in order to design new architectures that wants to be sustainable. Moreover, diagrammatic drawings will show how the urban and natural landscape is organized in a radial structure that has as a centre the old town and expands toward outside along 6 main directions. Already at this scale, it will be possible to notice that the city urbanization is mitigated toward South by the presence of a large park, called Parco Agricolo Sud, also important component of the project area. Finally, underlining the dense presence of small rivers among the territory of Milan it will be possible to understand why the small urban structure modifies its organizational grids according to the water path.
A particular attention is given to information concerning family structure characteristics and building layout diffusion within the Municipal boundaries through the presentation of graphics that build upon data collected by Istat, the main Italian Institute of Statistics. These informations will be useful to put Ronchetto S/N into a bigger realm context and will allow a more focused analysis of the project site.

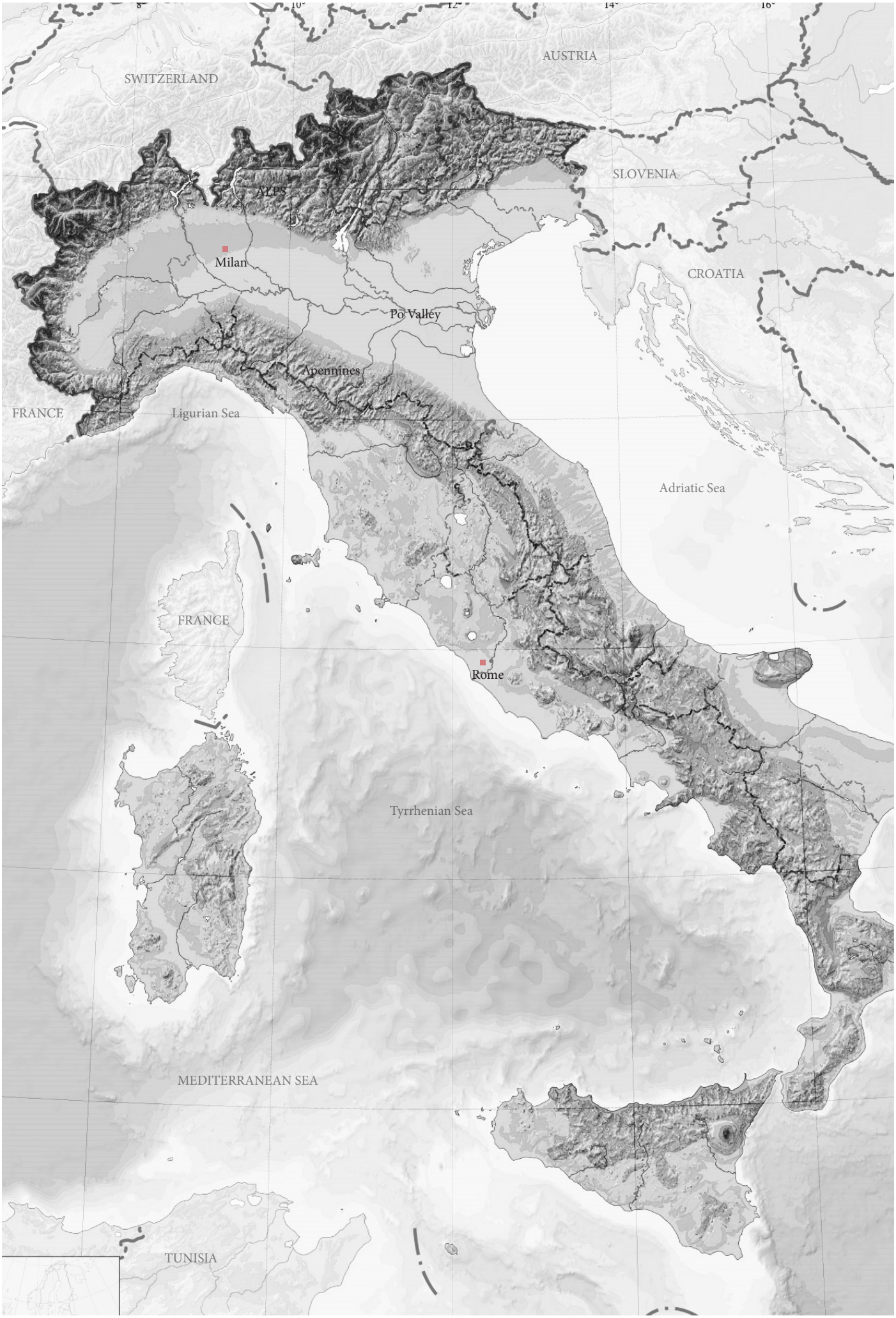
Focusing on the project area

Concerning the specificity of Ronchetto S/N, the present report analyses at a urban scale building density, functional distribution, connections with the neighbourhoods, and organizational grids of both buildings and natural elements, big part of the landscape of the project area.
A focus will be done on the urban typologies that border with the project area, showing how buildings with different functional aims organize themselves in plan and elevation, but also how they relate with the outdoor space. Finally, a materiality description of the existing will be briefly presented.

Prescriptions and potentials

The final part of this chapter will present the Municipality prescriptions for the development of Ronchetto S/N and will pinpoint the potentials of the area.
The municipality prescriptions are interpreted and visualized through diagrams, not meant to give an architectural definition of the space, but devoted to translate the numbers given in a spatial idea.
The potentials of the area are found thanks to a personal interpretation of the site analysis and take into consideration the Municipality requests. The presence of two main possible paths on the site will be shown: a cultural and a natural path.

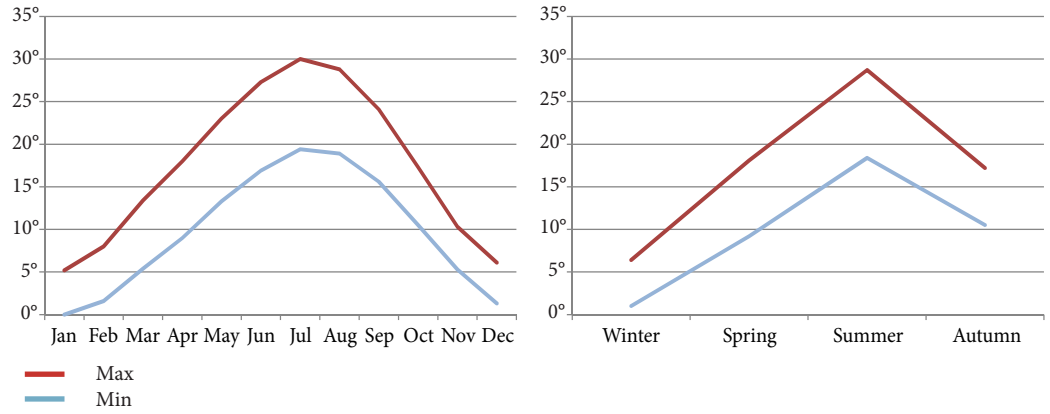
The analysis of the context together with the theoretical research on the theme of tectonic dwelling presented in *Part 1 - Learning from the Past* will be the starting point for the definition of a concept (see *Design Definition*) and a final design for the area (see *Design Presentation*).


AUSTRIA
SWITZERLAND
SLOVENIA
ALPS
Milan
CROATIA
Po Valley
Apennines
FRANCE
Ligurian Sea
Adriatic Sea
FRANCE
Rome
Tyrrhenian Sea
MEDITERRANEAN SEA
TUNISIA

Milan is the chief town of Lombardy, in the North of Italy. It has an overall area of 181 km^2 with around 1.341.830 inhabitants in 2011 (Gatti & Montrasio 2012), being the second Italian city for extension after the capital, Rome.
It is in the centre of the Po valley, between the Alps and the river Po, in an area originally paludal and where several springs flow from North to South.

Climate

The climate of Milan is considered semi-continental. It has indeed warm summers and cold winters, with an annual thermal excursion of about 30 °C. Nevertheless it has less raining days than the typical continental cities in Europe, reaching a level of about 980 mm of rain a year. Finally, being protected by the geographical conformation of the area, the wind on Milan doesn't reach high speeds, with an average per year of 2,4 m/s. The graphics below visualize the climatic data collected.



Diagrams of the temperature trend in Milan along the year. On the left, average temperature per month; on the right, average temperature per season.

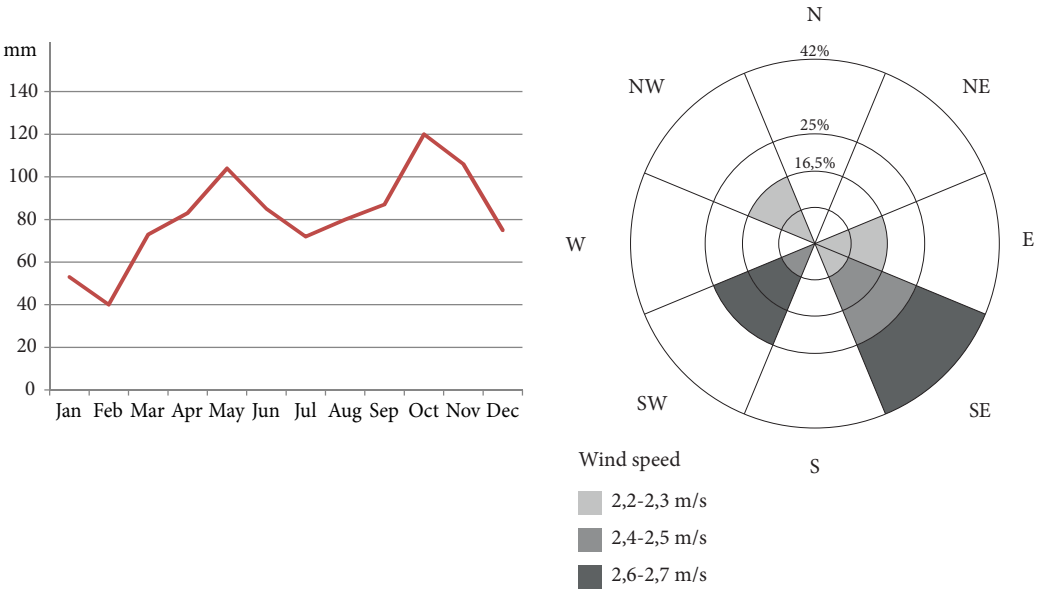
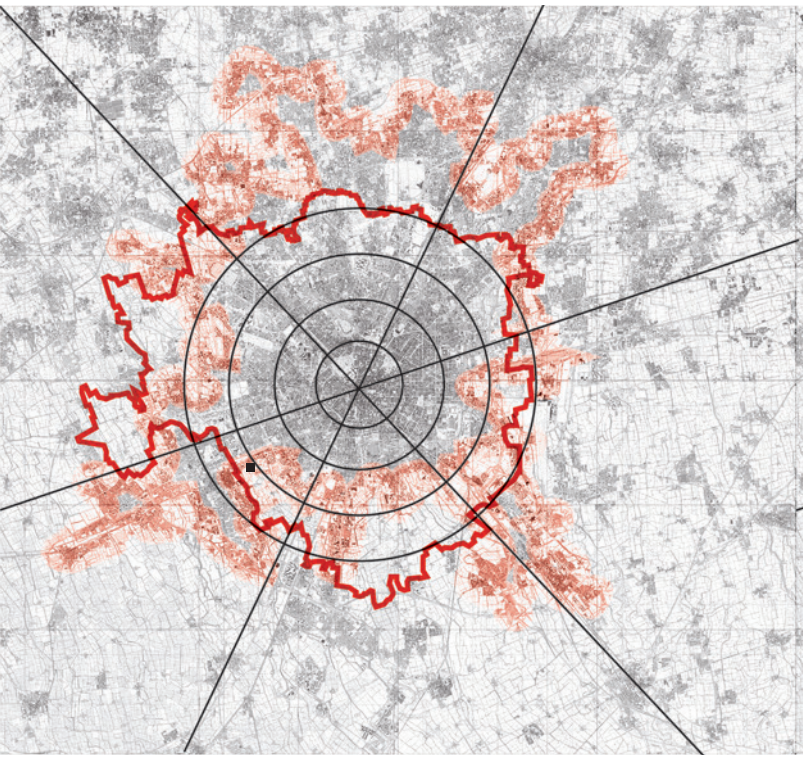


Diagram of the rain level along the year (left) **and wind path** (right) **of Milan.**

The natural presence

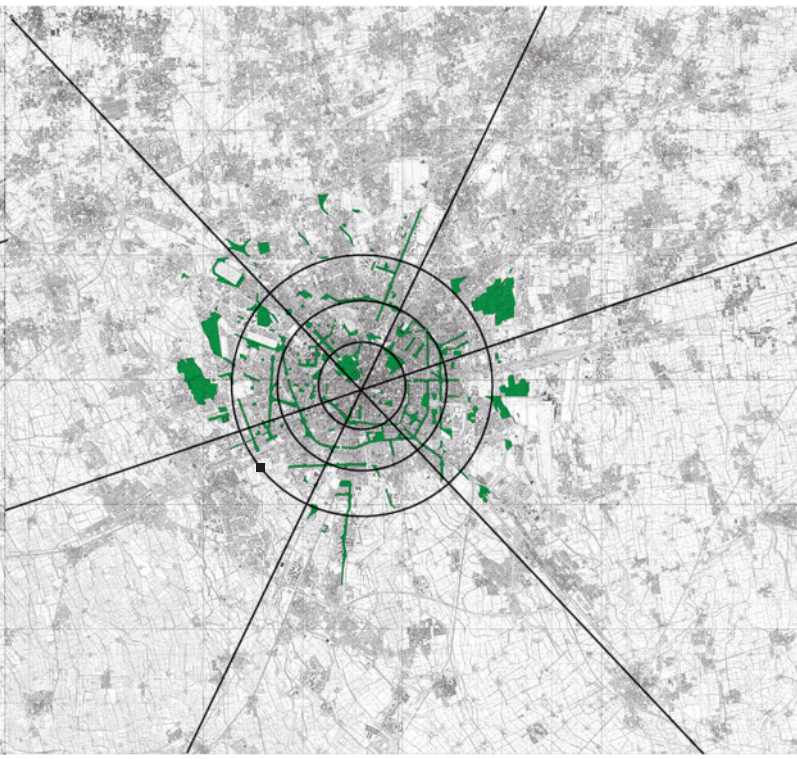
The urban environment of Milan is organized along 6 main lines, convergent in the centre. This structure is followed by both buildings and green areas (see diagrams 1 and 2 in the next pages).
The South border of the city is pulled alongside the Parco Agricolo Sud, park constituted by agricultural fields still in use and punctually supported by diffused farms (see diagram 3 in the next pages).
Water is an important element of the territory, designing the landscape conformation, both urban and natural (see diagram 4 in the next pages).
Nowadays, most of the natural and artificial rivers inside the city flow under the urban level, but Naviglio Grande, in the South West of the city is still opened and constitutes one of the main river of Milan.

Diagram 1



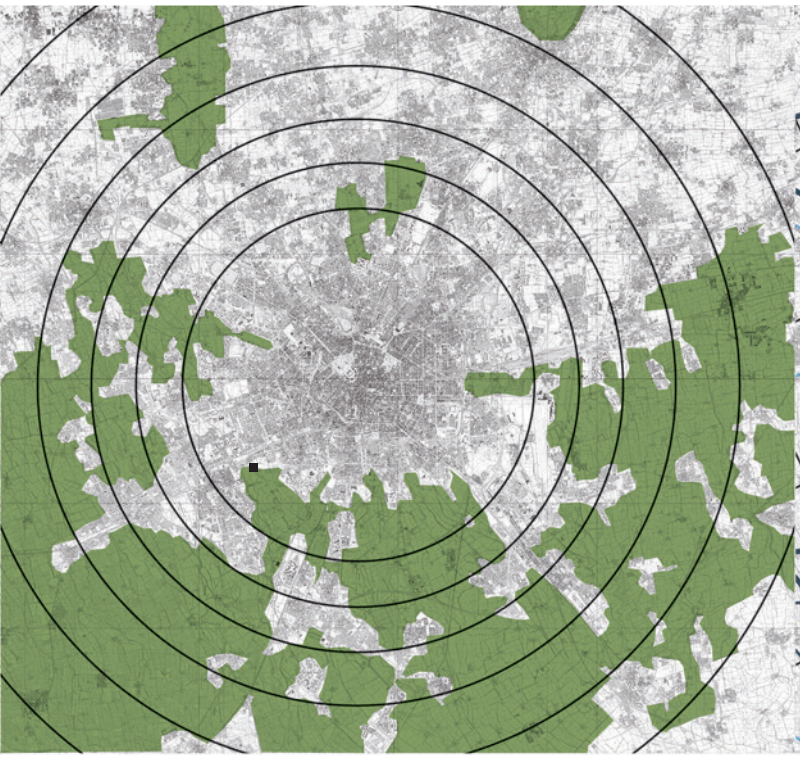
City borders
- Real
- Perceived
- Organisational grid
- Project area

Diagram 2



Green areas 1
- Urban green areas
- Organisational grid
- Project area

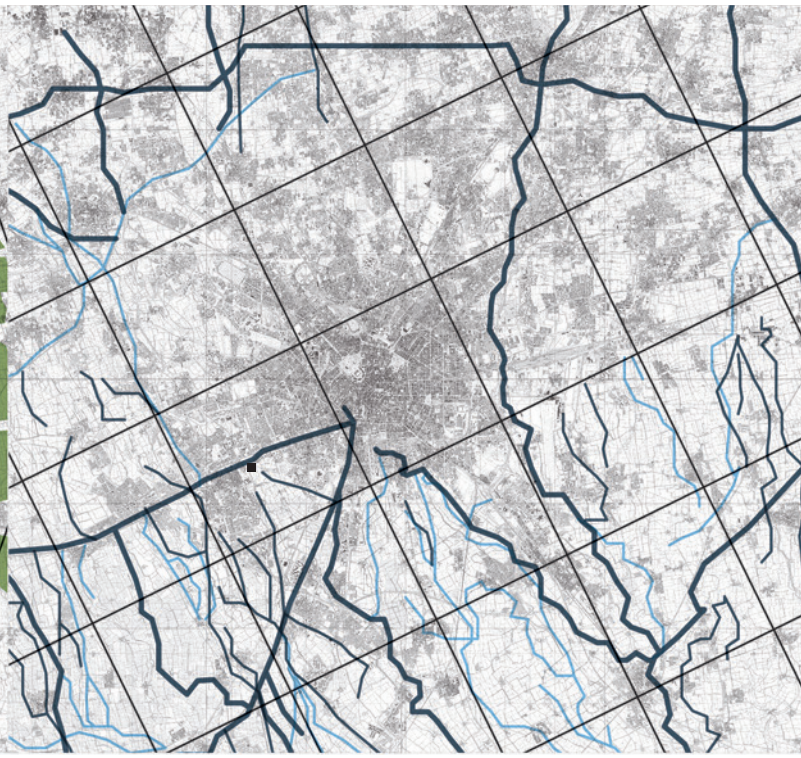
Diagram 3



Green areas 2

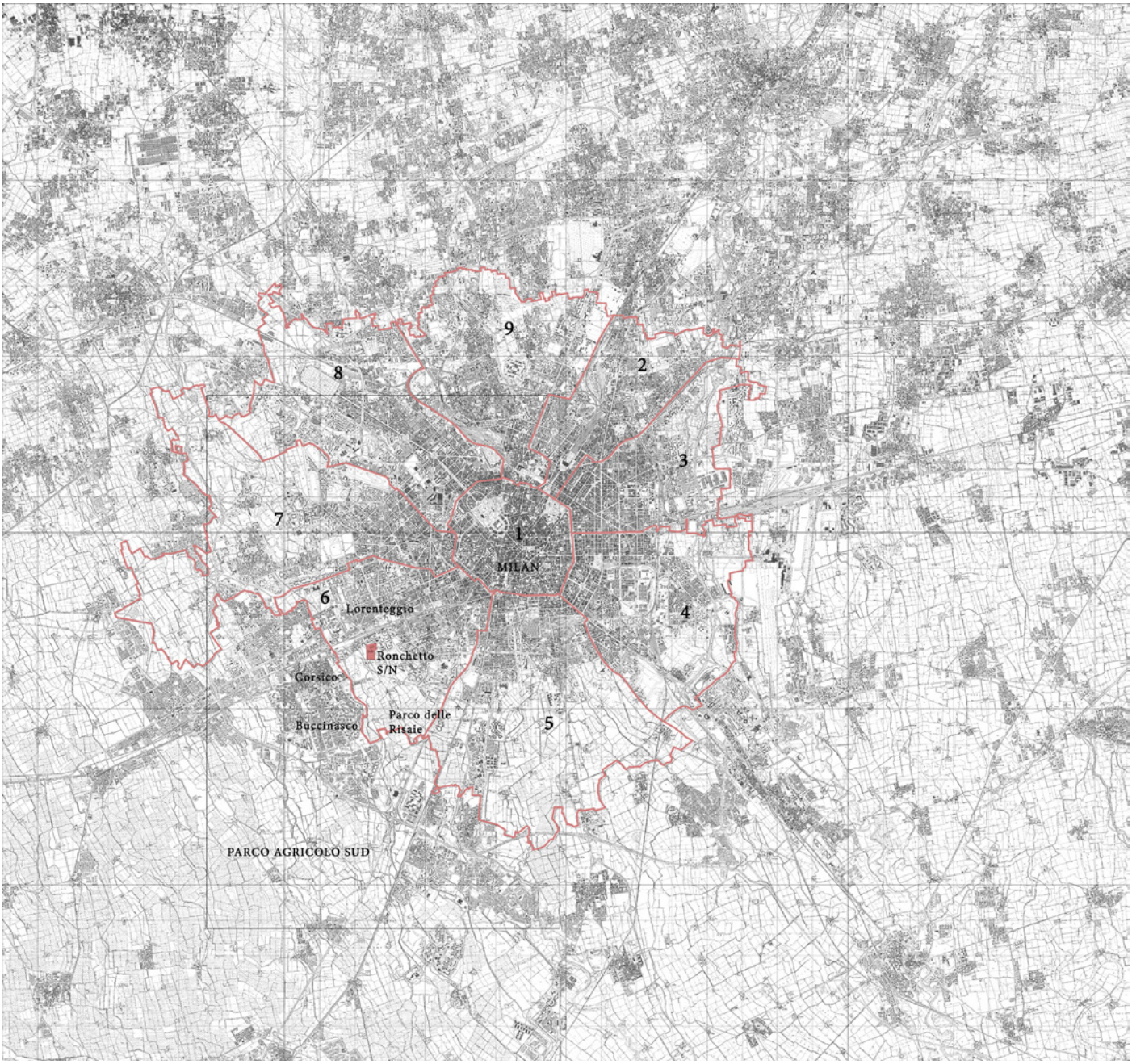
- Parco Agricolo Sud
- Organisational grid
- Project area

Diagram 4



Water

- Main rivers
- Main springs
- Organisational grid
- Project area



Site location

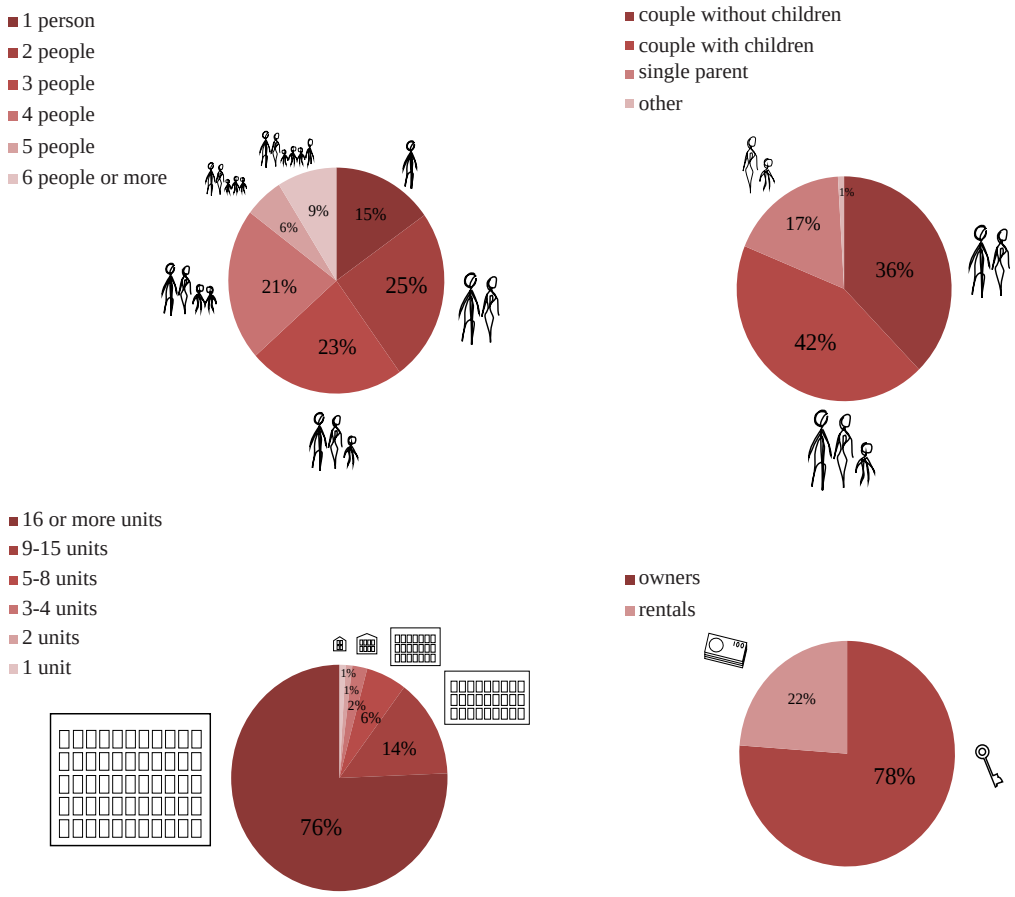
- Project area
- Zoom 1
- Administration areas of the city

Directional role

Thanks to its central position into the European territory, Milan has always been an important city. Founded in the VI century b.C., Romans conquered it in 222 b.C., reclaimed its land and called it Mediolanum. In its history, it had different roles for the region around it, including the one of capital of the Ducato di Milano (in the Renascence) and of the Regno di Italia during the Napoleon Era. In the XIX century the city became the main Italian industrial centre, creating with Genoa and Turin the "industrial triangle". After the First World War it had a strong demographic growth, especially due to the internal Italian migration from South to North. Actually, Milan is the fashion, design, economical and financial centre of Italy.

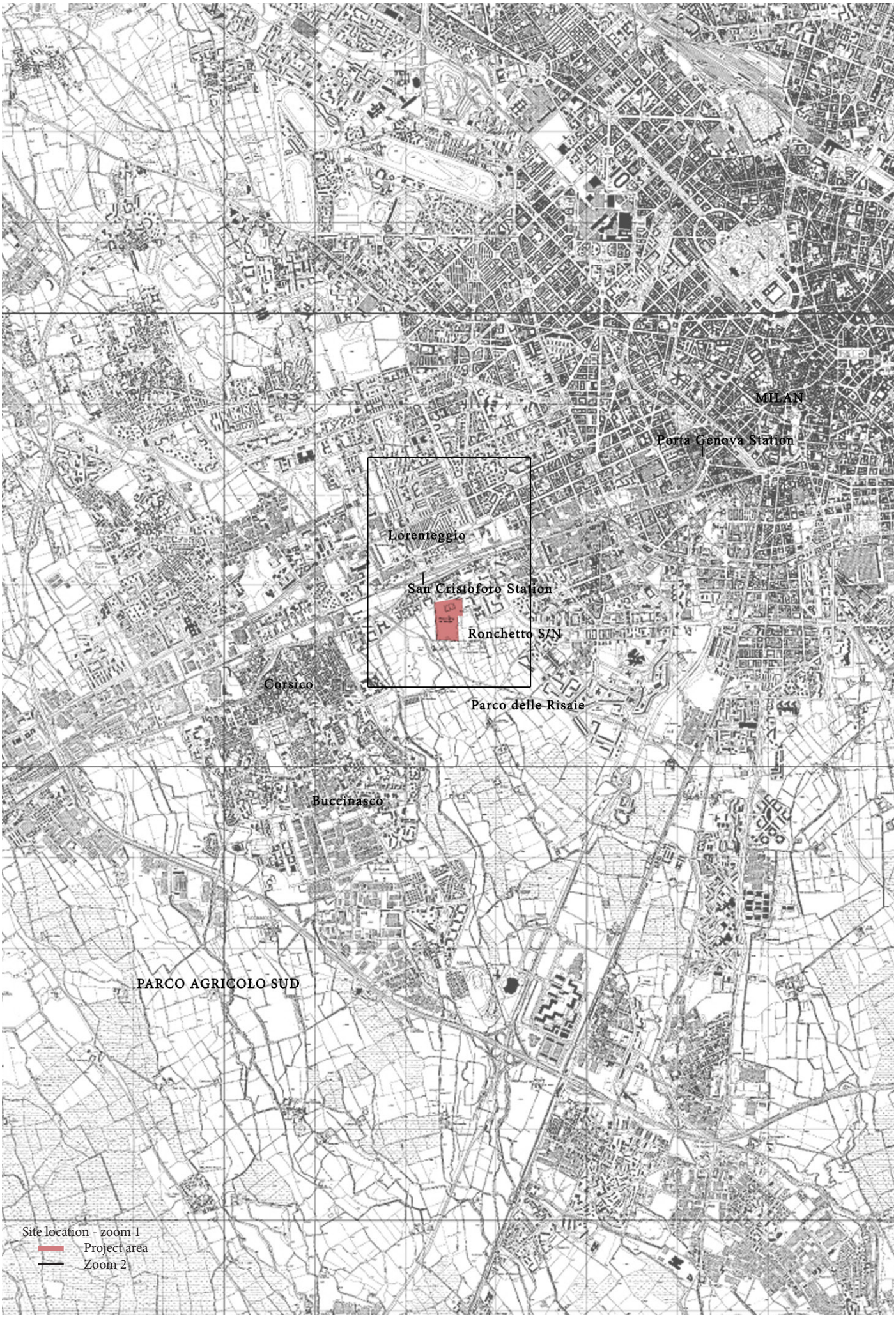
Living in Milan

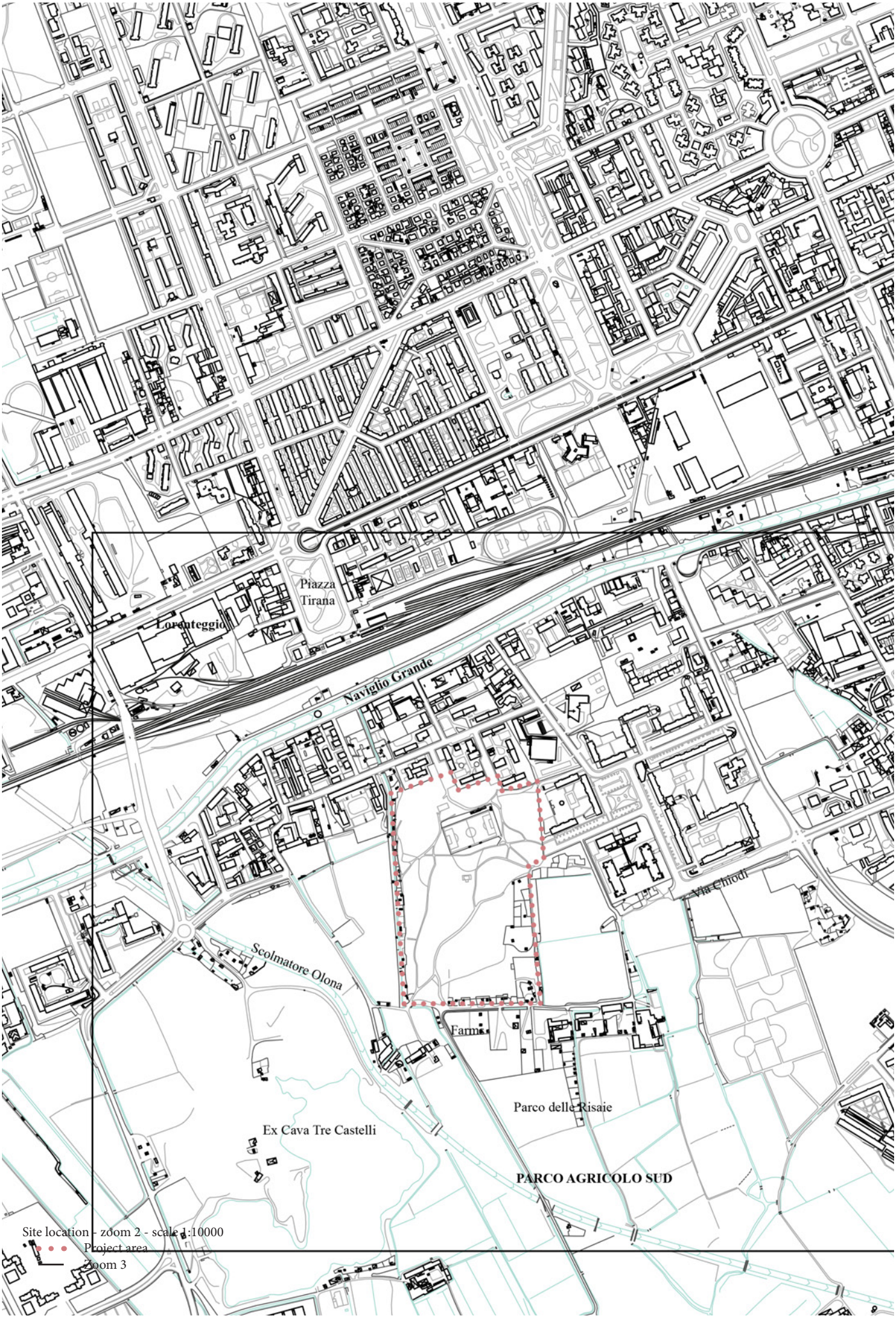
According to the statistics collected by the Municipality of Milan, the city has a surface of 181,76 km^2 and an average density of 7382,4 citizens/km^2 and in particular the administration area 6, of which Ronchetto S/N is part, has a density of 8123.9 citizens/km^2. (Gatti & Montrasio 2012, data updated at December 2011). From the same document, it is possible to read that in average each citizen has the access to 16,1 m^2 of green space and 23, 8 m^2 of built space.



Diagrams of Family and dwelling situation in Milan. From the top left: family nucleus frequency; nucleus organization into the apartments; frequency of building typology; type of ownership.

Moreover, from the diagrams above, drawn from data collected by Istat in 2011, it is possible to notice how families in Milan are mainly composed of nucleus of 3 or more people (59% of the population), while the 25% are couples without children and the 15% are single member's family. Differently, the 53% of people lives in groups of 2 members, underlining how the family nucleus composition not always corresponds to the way in which people live together.
Other notable information from the diagrams is that the largest amount of dwelling buildings in Milan collects 16 or more family's units, while only the 1% is a single family house.
Finally, the 78% of citizens are owners of their housing.
Nonetheless, the prices of an apartment in Milan are quite high compared the ones of other Italian cities. To give some examples: the price per square meter of an apartment in Milan goes from a minimum of €2100 to a maximum of €13800, whereas in Rome it goes from €2500 to €13000 and in Turin from €1050 to €4900 (Il Sole 24 Ore 2015). Moreover, it is important to underline that the average Italian salary in 2013 was of €1327/month, whereas the salary of young graduated up to 35 years old was between €800 and €1000 (Lo Stipendio Medio 2014). This information makes clear the difficulty or impossibility especially for young people to live alone.

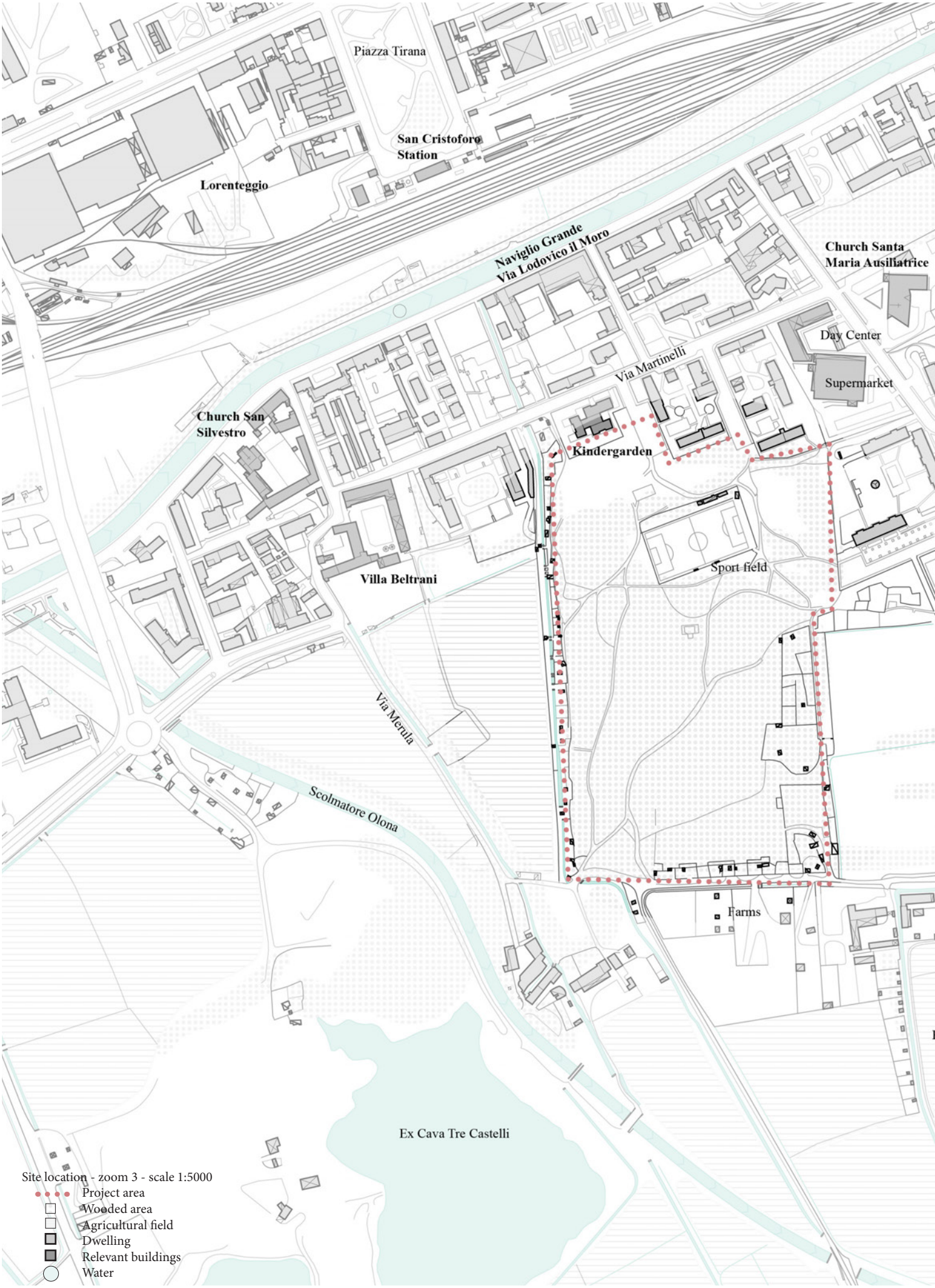

MILAN
Porta Genova Station
Lorenteggio
San Cristoforo Station
Ronchetto S/N
Corsico
Parco delle Risaie
Buccinasco
PARCO AGRICOLO SUD
Site location - zoom 1
Project area
Zoom 2

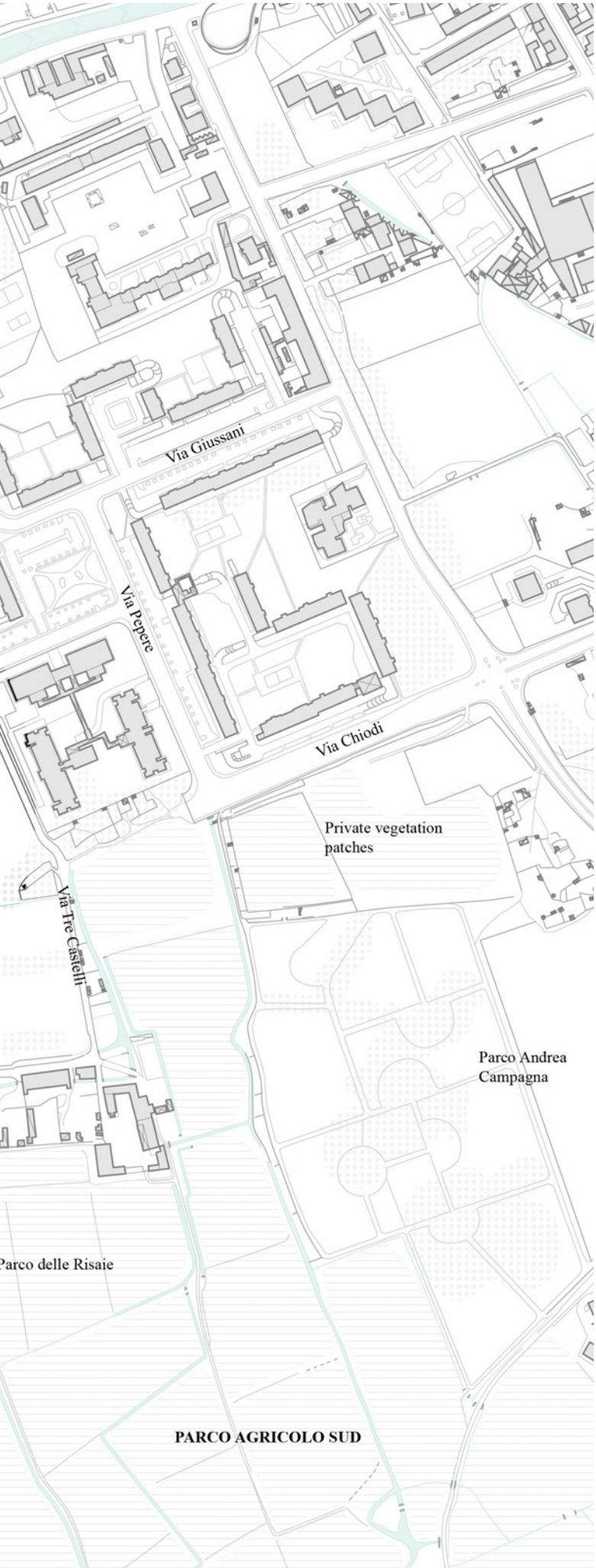


Site location - zoom 2 - scale 1:10000

Project area

Zoom 3


Piazza Tirana
San Cristoforo
Station
Lorenteggio
Naviglio Grande
Via Lodovico il Moro
Church Santa
Maria Ausiliatrice
Day Center
Supermarket
Via Martinelli
Church San
Silvestro
Kindergarden
Villa Beltrani
Sport field
Via Merula
Scolmatore Olona
Farms
Ex Cava Tre Castelli
Site location - zoom 3 - scale 1:5000
Project area
Wooded area
Agricultural field
Dwelling
Relevant buildings
Water



Ronchetto Sul Naviglio is nowadays an area on the borders of Milan, but it was originally an autonomous municipality. The name belongs from a farm that was on the river Naviglio Grande. The original urban structure along the river is today completely changed and the area is totally inserted into the urban development of Milan.
On the West, the area adjoins with the Communes of Corsico and Buccinasco, while on the North, over the bridge that surpass Naviglio Grande, there's the Milanese area of Lorenteggio, in which the station called San Cristoforo connects the zone on North East with the city centre, with the station of Porta Genova, and on South West with Corsico.
Relevants on the site are the Villa Beltrani and the Strada Vigevanese (composed by the ensemble of Via Milano, Via Vigevanese, and Via Ludovico il Moro), along the river Naviglio. The two are in fact considered elements of historical interest for the city.

In the next pages, a series of maps will help the readers to understand the conformation of the project area, which although actually characterized by the sole presence of a wooden area, its surrounded by dense building complexes.
Hence it will appear clear that the project area has two main vocation: a natural and an urban one, where the natural is more concentrated on the South and the urban on the North (see diagram 1 at page 120).
Moreover, it will be possible to notice that even though along the built borders dwellings are the most diffused there are some important buildings with cultural relevance (see diagram 2 at page 120).
Other focus will be possible on the fact that the project site is connected to the city centre thanks to the presence of public transportation (see diagram 3 at page 121) and that the urban grids follow both the natural and the artificial components (see diagram 4 at page 121).

Diagram 1

Urban Density

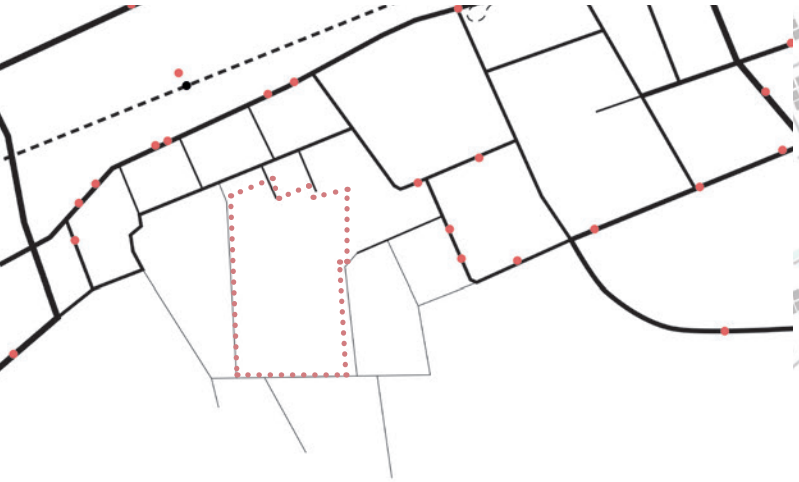
- Building directly influencing the project area
- Other buildings
- Project area

Diagram 2

Urban functions

- Dwelling
- Farms
- Commercial
- Sport
- Industrial
- Cultural
- Sacral
- Project area

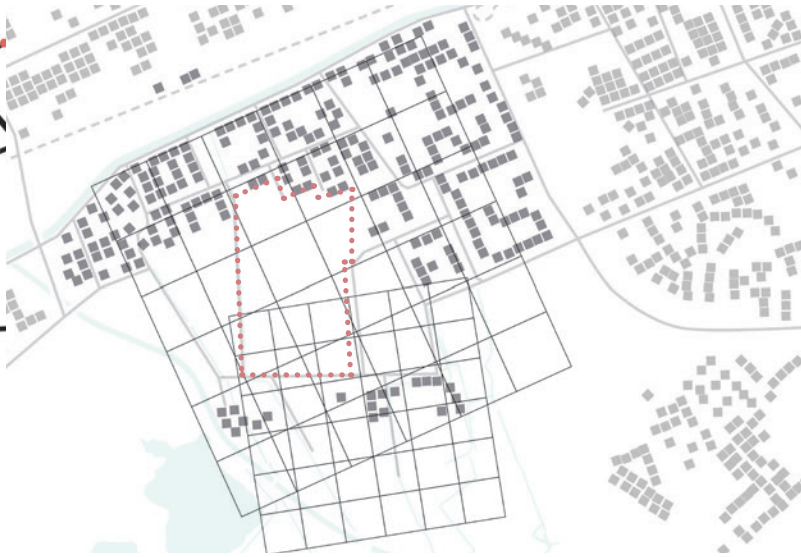
Diagram 3



Transports

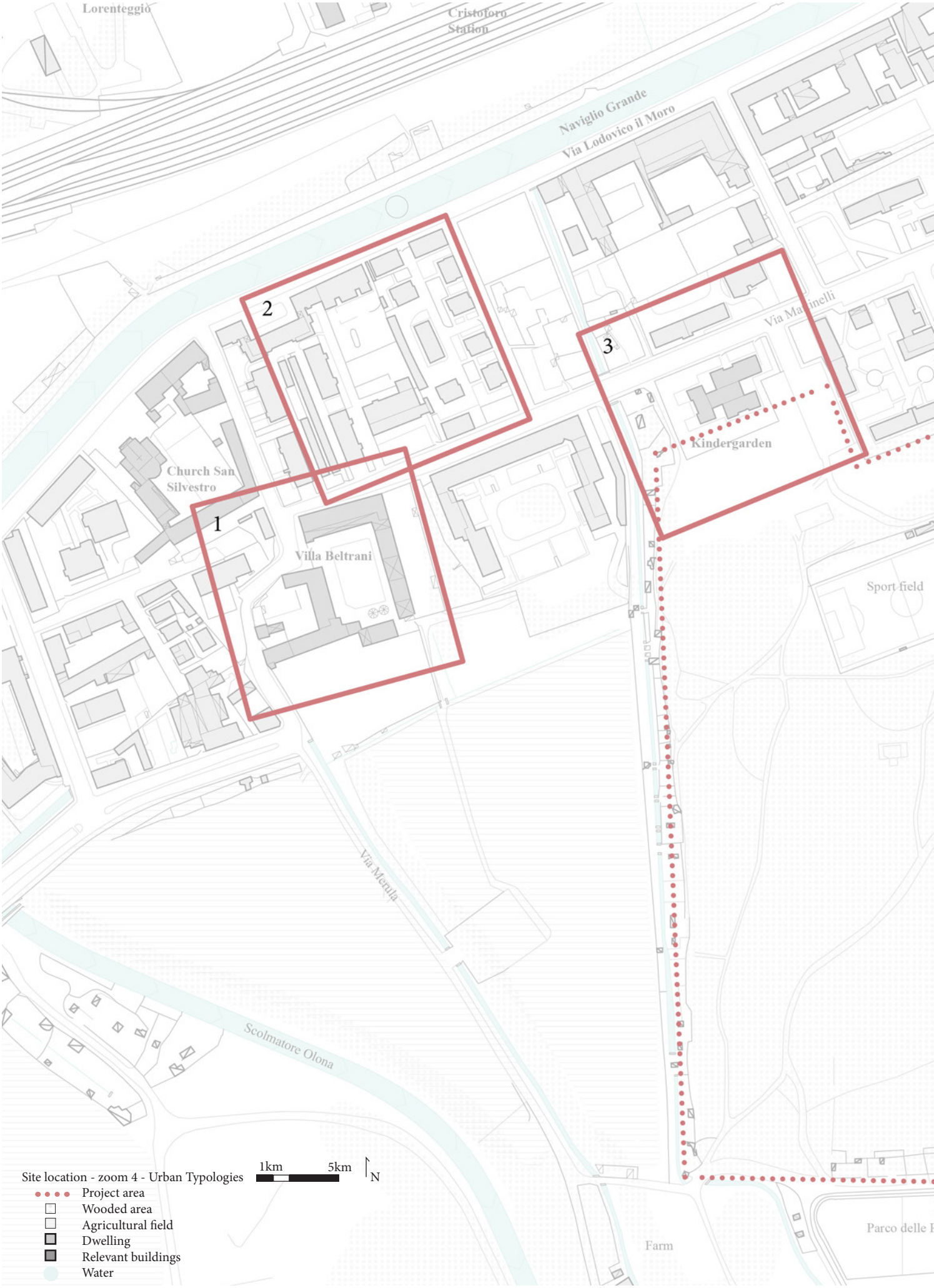
- Streets (thickness corresponds to relevance)
- Railway
- Train Station
- Bus stop
- Project area

Diagram 4

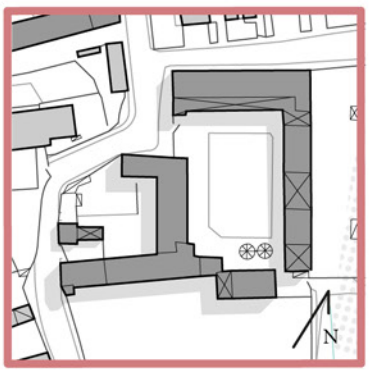
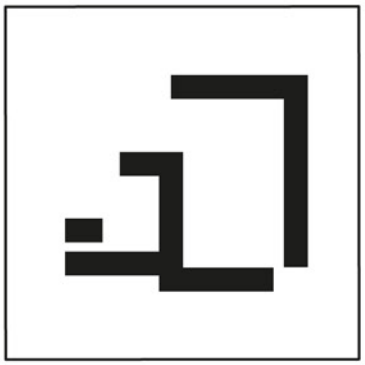
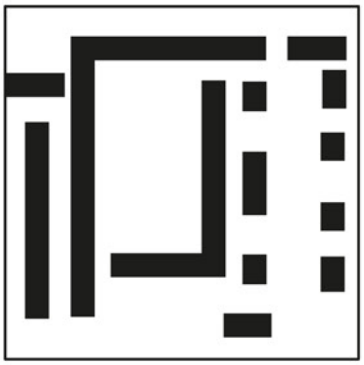
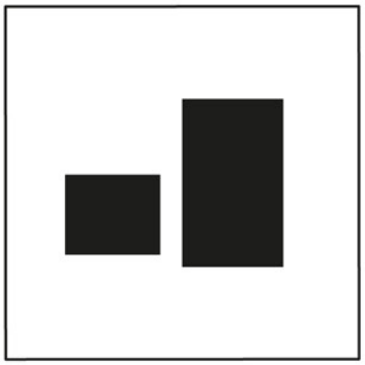
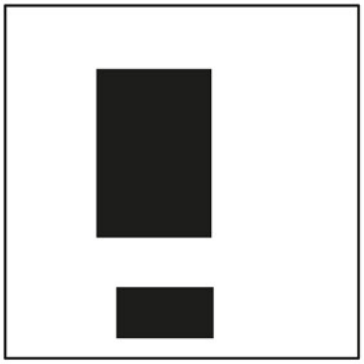
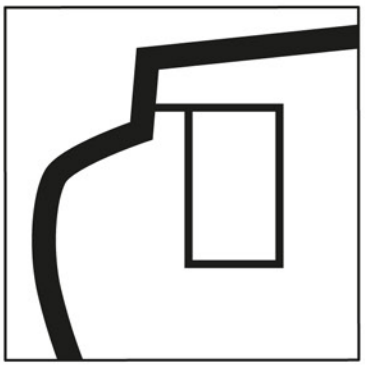
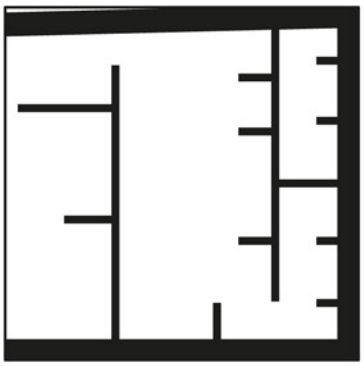
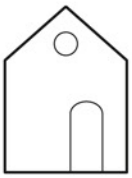
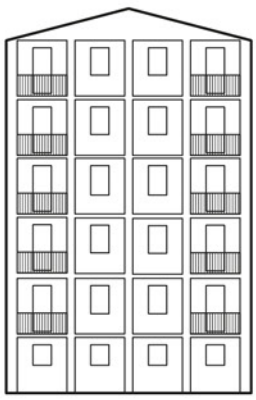
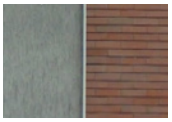


Grids

- Grid
- Building distribution
- Streets (thickness corresponds to relevance)
- Railway
- Water
- Project area

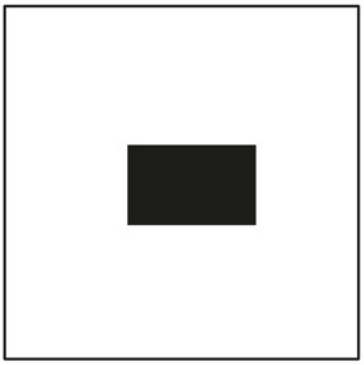

Lorenteggio
Cristoforo
Station
Naviglio Grande
Via Lodovico il Moro
2
3
1
Church San
Silvestro
Villa Beltrani
Kindergarden
Sport field
Via Merula
Scolmatore Olona
Farm
Parco delle
1km
5km
N
Site location - zoom 4 - Urban Typologies
Project area
Wooded area
Agricultural field
Dwelling
Relevant buildings
Water

In the next pages a closer zoom will be done in order to specifically analyse different urban typologies around the project area. First of all, it will be describe the historical complex of Villa Beltrani, secondly a typical residential complex, consequently the small kindergarten that will face the new project, and finally the building that compose the local day-centre.
Each of them will be described through diagrams that extract the main characteristics of the plan organization of the typology, at the level of the building, the open area and the paths organization. In this way the analysis follows the scheme defined in the chapter 2 of the previous part, *Permanence and Authenticity*, used to analyze Tadao Ando case study underlining the architectural strategies applies in Rokko Housing at the landscape scale.
Moreover, the typologies here presented will show the simplification of the building profile underlining the main materials used for the facades. In this way it will be possible to have a range of options related to cladding and construction materials that are typically present on the area. This will guide the choice of the new project materials for structural elements and other details following the concept of authentic architecture.

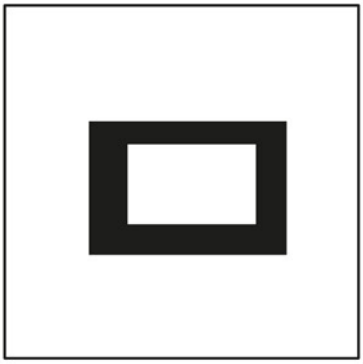
	1. Villa Beltrani		2. Residential complex	
Dimensions and diffusion		2 floors building cluster. A similar organization can be found in the farms located at the South border of the project area.		7 or 5 floors building complex. A similar organization is typical of all the dwelling buildings surrounding the project area.
Form		Building organization around internal courtyards.		Buildings organization around internal courtyards or in line.
Open space organization		Division of the open spaces according to functional issues.		Division of the open spaces according to function issues. Nevertheless, the height of the buildings around them makes the courtyards being largely in shadow.
Distributional paths		Internal circular path around the main courtyard.		Strong delimitation of the area by the main paths. Linear internal circulation.
Profile and materiality		Profile typical of a Lombard farm. High ground floor and granary under the pitched roof. Main material:  red bricks, in some case covered by plaster and painted in light yellow.		Modularity and rigid scan of the facade through the underlining of structural elements. Difference between ground floor layout and other floors. Pitched roof. Main materials:  red bricks and rough concrete.

3. Kindergarten

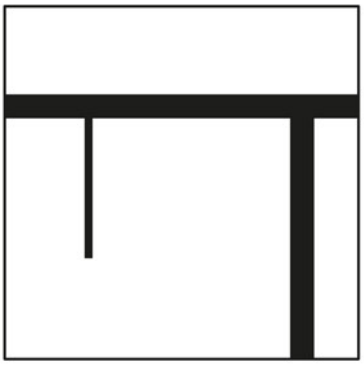
1 floor compact building.
This layout is unique on the analysed area.



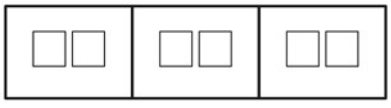
Built area condensed in the centre of the pertinent area.



The open space surrounds the building.



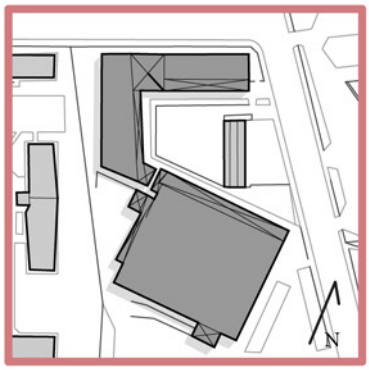
The building is aligned to the main streets of the area.



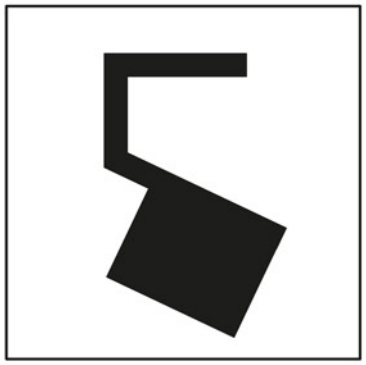
Profile typical of a prefabricated building.
Modularity and repetition.
Main materials:

Prefabricated light panels and glass.

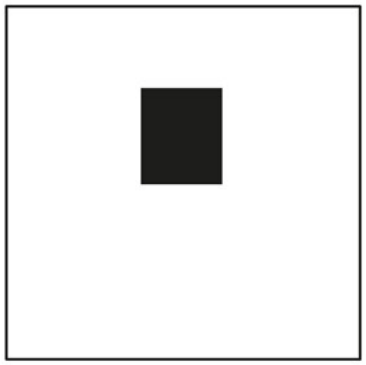
4. Daycenter



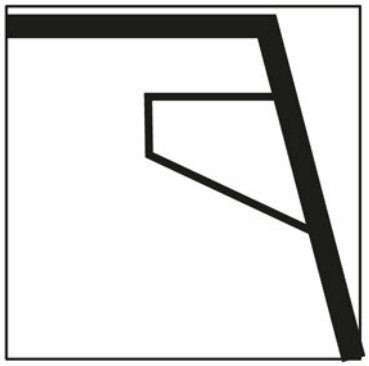
1 floor building complex.
This typology is unique on the area, but with characteristics that can be found in other typologies.



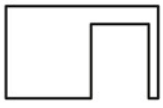
Buildings organization around a courtyard.



The courtyard is opened to the main street on the side and represents the entrance space of the complex.



The building is aligned to the main streets of the area. Secondary paths create a ring around the court.



The building is opened to the public and uses a porch along the facade to underline his vocation.
Main cladding material:

Stone tiles. Some details of the facade are covered in plaster and coloured in red.

New Density of the Site

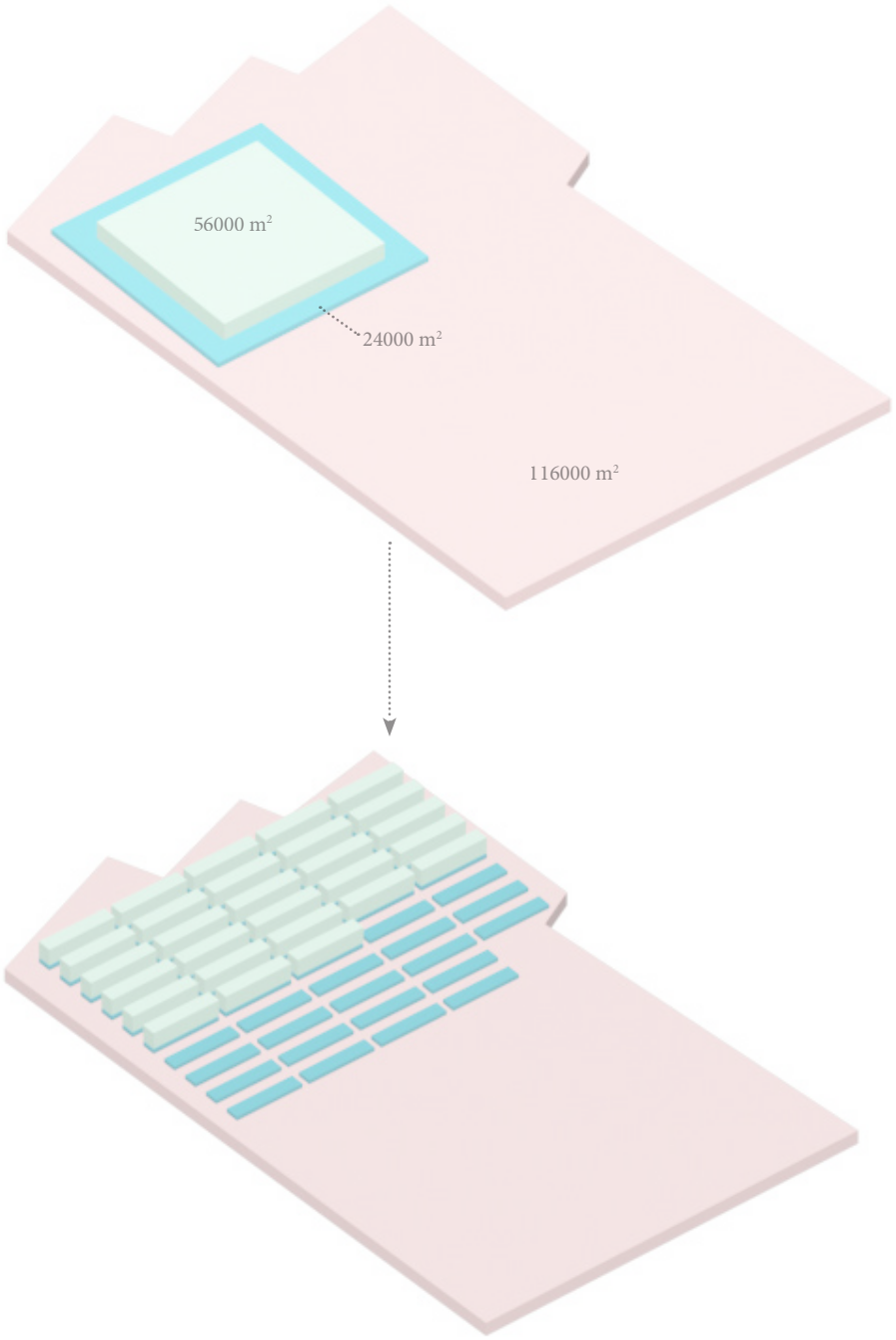


Diagram of the new urban density - First and second visualization

- Project area
- Dwellings
- Services

Even if actually the presence of the Parco delle Risaie, part of the Parco Agricolo Sud is predominant on the area of Ronchetto S/N, the area is part of a strategic plan of renovation of the city of Milan that previews new urban areas with a large part of residences.
In the following lines is possible to read the synthetic collection of targets and prescription of the Municipality.

Targets:
- Complete the park Parco delle Risaie;
- Guarantee a connection between the designed park and city centre;
- Sustain the centrality of green areas in the realization of new urban complexes;
- Stimulate the function mix;
- Gives the necessary services to new residences.

Prescriptions:
- Realize a park of minimum 50% of the area;
- Realize a green corridor (section minimum 5 meters) along via Crivelli, Pepere, Tobagi, and Ponti;
- Realize new buildings with a density of 69%;
- Dedicate the 30% of the built area to public services;
- Connect via Merula and via Chiodi.

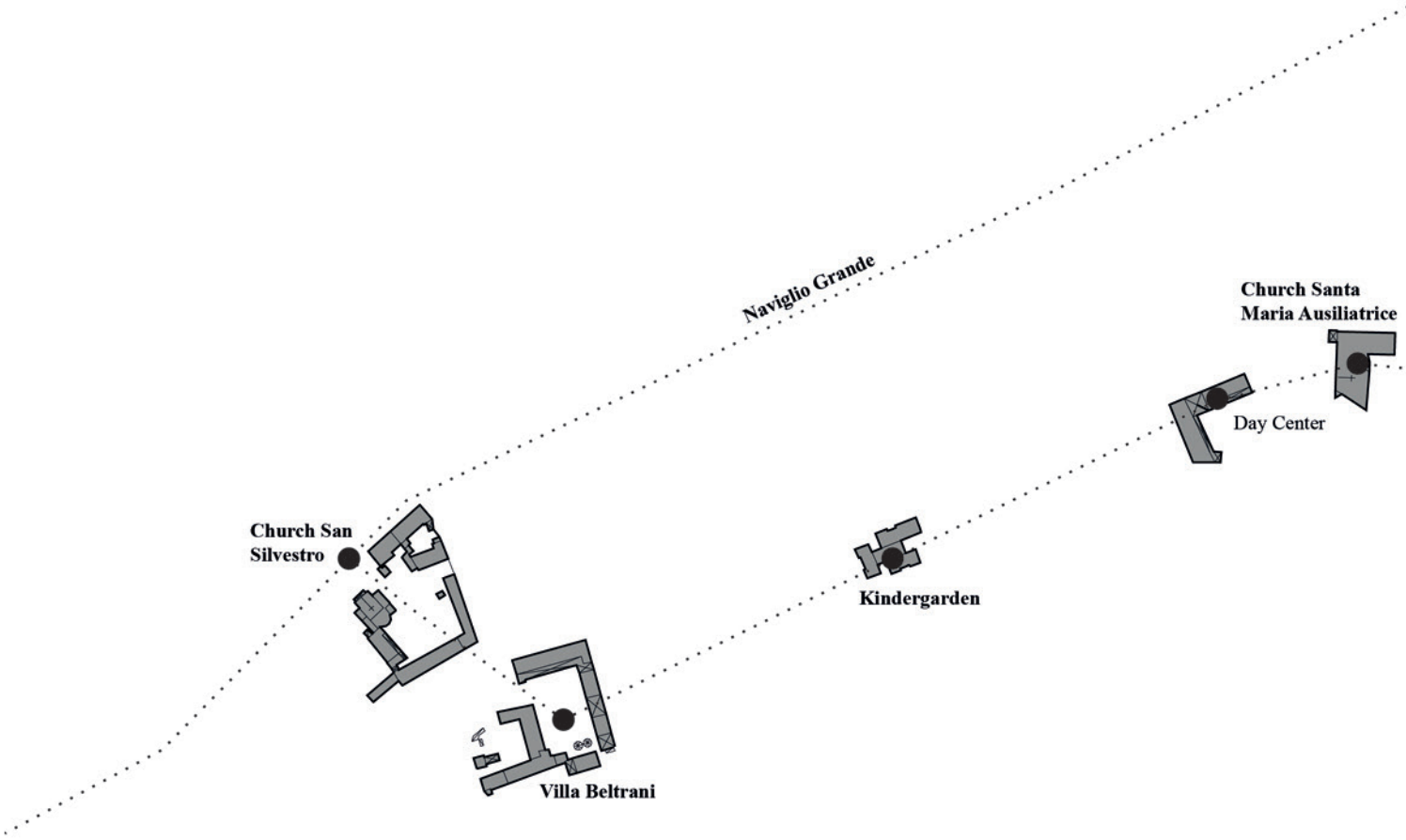
Numerical description

Since the project area has a surface of 116000 m^2, the municipality prescriptions translate in:
- Realization of a park of minimum 58000 m^2;
- Realization of new buildings for a total of maximum 80000 m^2.
- Considering the 30% of the built area (corresponding to 24000 m^2) reserved to public services, 56000 m^2 could be destined to new dwellings (34000 m^2 at the ground floor).
- In order to simplify the calculations, we can consider that a flat unit has a surface of 100 m^2, determining that it is possible to build on the project area around 560 new apartments.

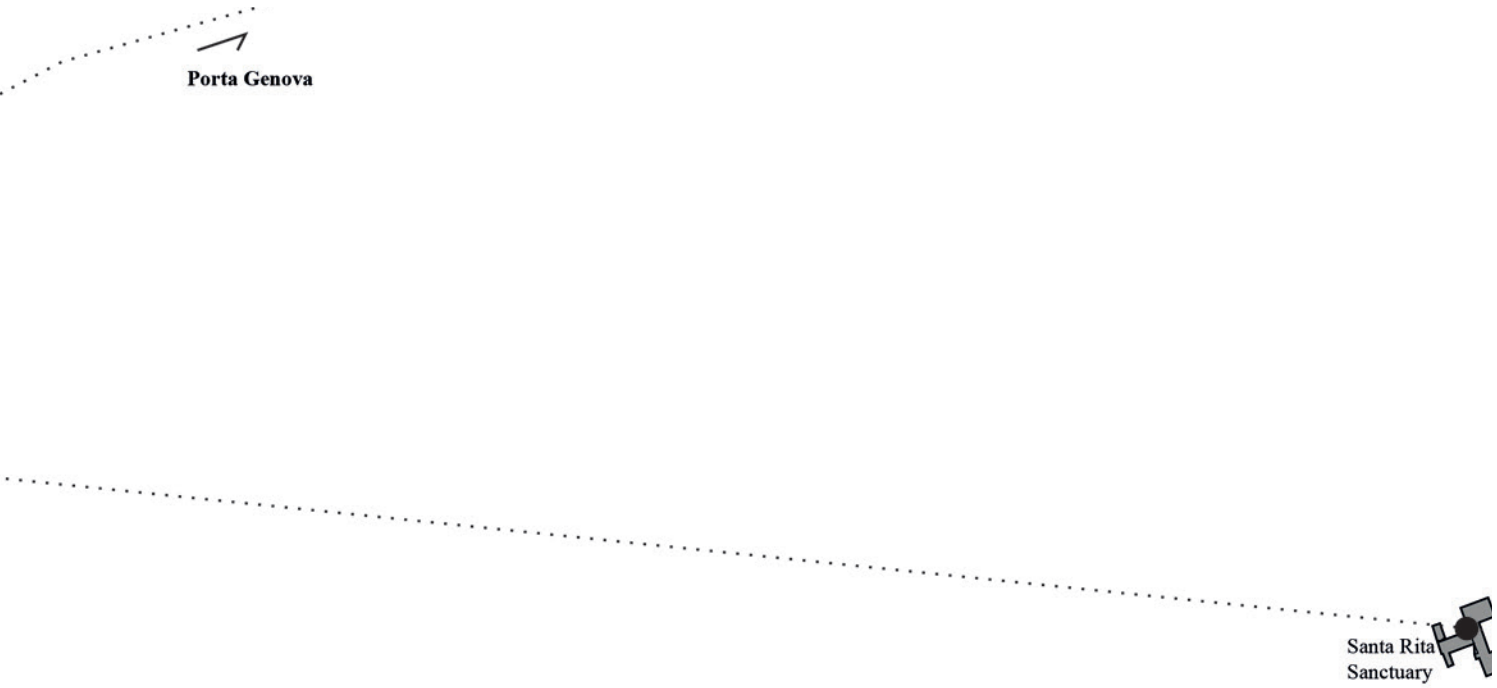
As a result, we could imagine to build 28 buildings 10mX50m with 20 units each, organized on 4 floors (see diagram on the side).
The last diagram presented respects the technical requirements of the Municipality of Milan, summarized in the document *Regolamento Edilizio* (Comune di Milano 2013). The buildings have indeed a distance of 10m between the facades that are most likely opened with windows, and a distance of 5m between facades that we can imagine without windows. Moreover, large part of the site area is left without new buildings, allowing the required destination of the 50% of the site to a urban park.

From buildings to sensuous architecture

Nevertheless, we can notice that a similar urban organization does not take into consideration the existing surrounding thus does not consider the specificities of the realm in which it is placed. On the contrary, as largely stated before the present thesis aims to create a site-specific and tectonic new urban environment. For this reason, in the next pages the readers will be guided toward the definition of a program and a final design that answers to the necessity of sensuousness, authenticity and flexibility of the space in order to create the contemporary tectonic architecture for dwelling defined in the first part of the present report.



Cultural Path - Large vision. scale 1:5000



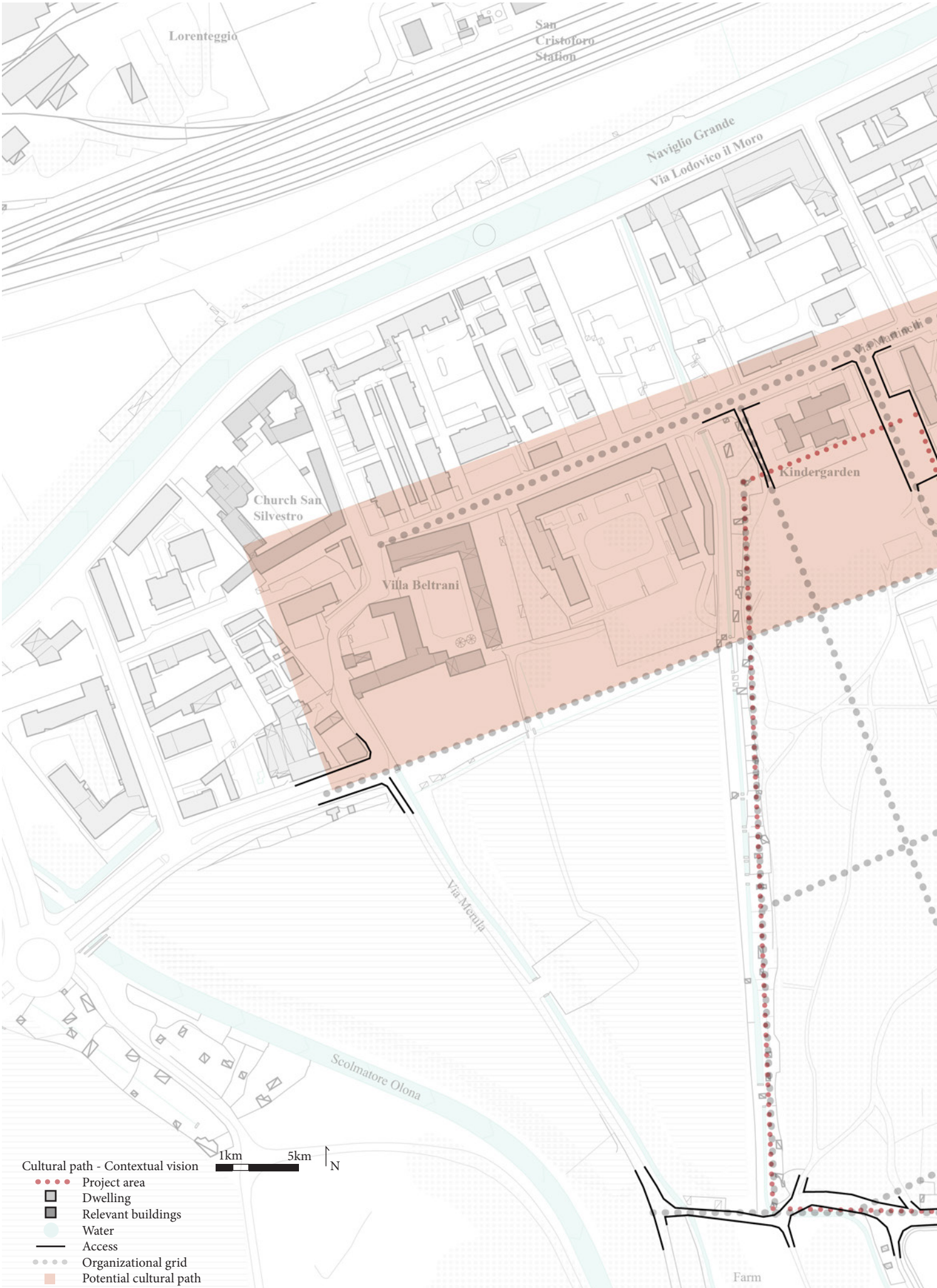
POTENTIALS

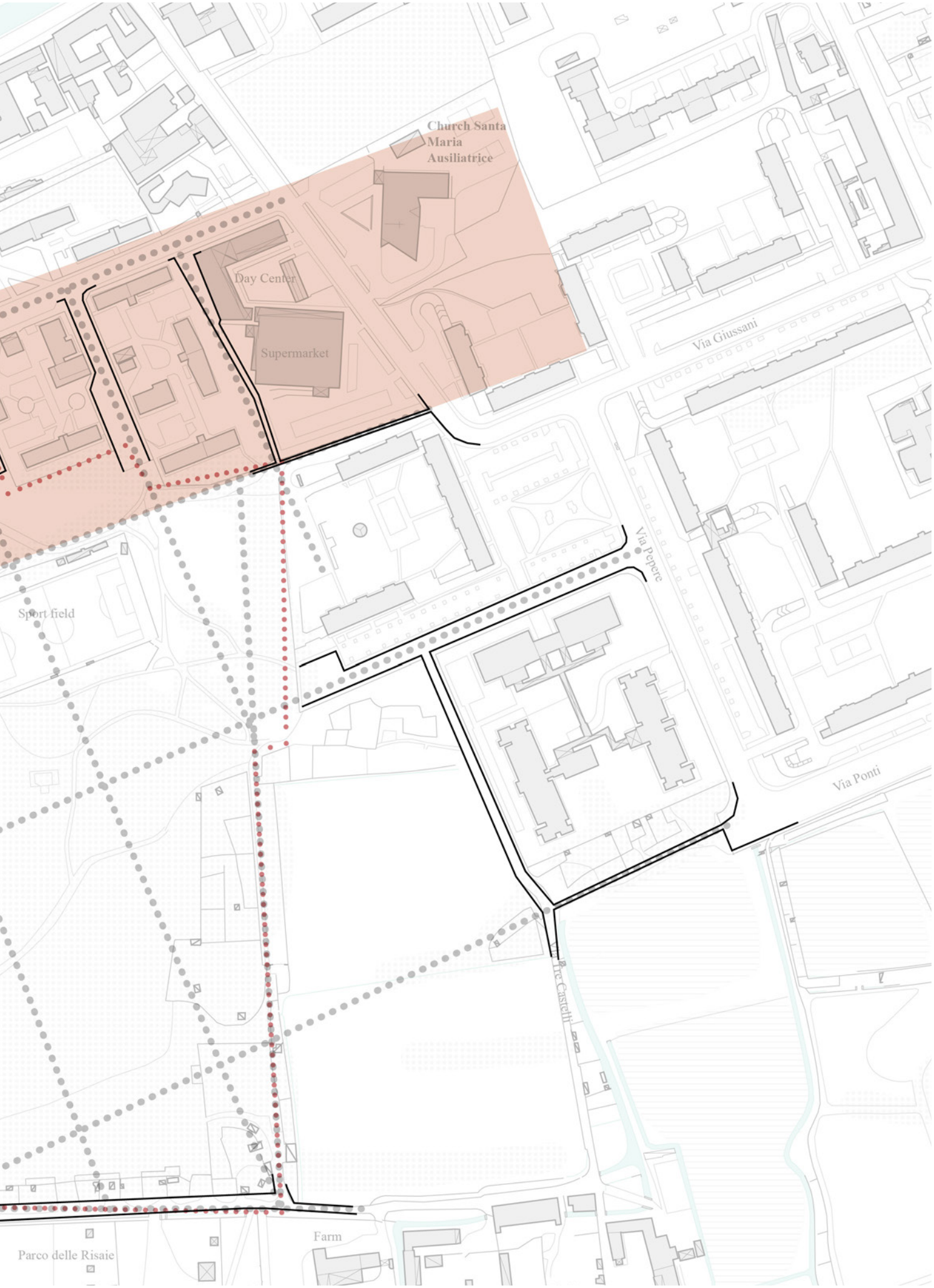
The cultural path

As we saw through the site analysis in the previous pages, the immediate surroundings of the project area host different cultural sites, such as Churches, Kindergarten, and day centre. The diagram shown at the pages 132-133 extrapolates these sites from the context and underlines the possibility to connect them through a strategic urban planning.
In order to do this, into the project area would be necessary to create a cultural path that crosses the area from South-West to North-East (see pages 134-135).

The natural path

Thanks to the proximity with the park "delle Risaie", the urban development plan of the city of Milan previews in the area of Ronchetto sul Naviglio the integration between urban tissue and natural context of the Parco Agricolo Sud. At pages 136-137 it is possible to notice thanks to a diagrammatic drawing the potential of the natural site connection between areas around the project site: Piazza Tirana, Naviglio Grande, sport fields, and Parco Agricolo Sud are indeed put in a sequence from North-West to South, defining the possibility to create within the project borders a natural/sportive path in this direction (see pages 138-139).

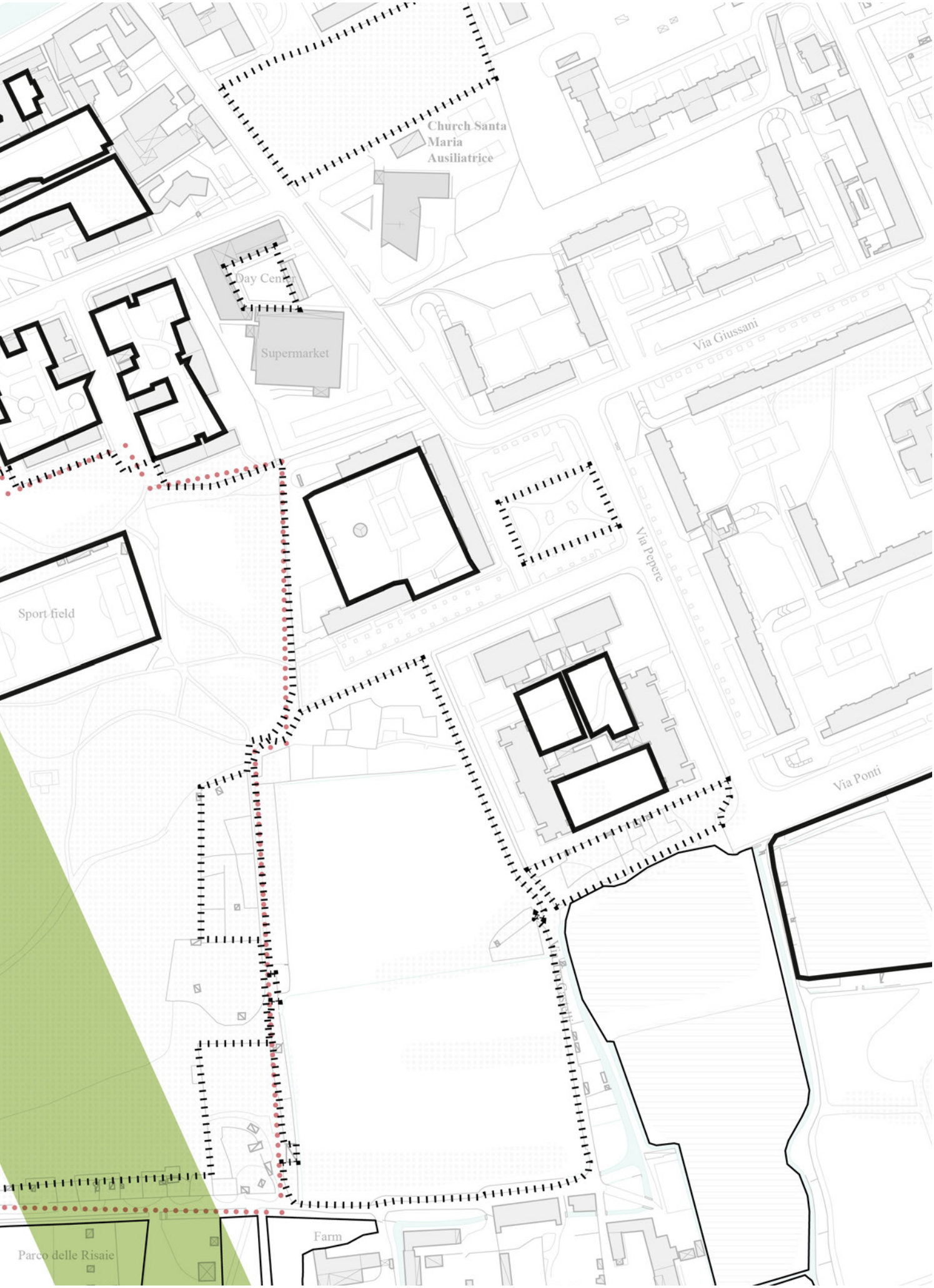

Lorenteggio
San Cristoforo Station
Naviglio Grande
Via Lodovico il Moro
Via Mannucci
Kindergarden
Church San Silvestro
Villa Beltrani
Via Merula
Scolmatore Olona
Farm
Cultural path - Contextual vision
1km
5km
N
Project area
Dwelling
Relevant buildings
Water
Access
Organizational grid
Potential cultural path


Church Santa
Maria
Ausiliatrice
Day Center
Supermarket
Via Giussani
Via Pepere
Sport field
Via Ponti
Tre Castelli
Farm
Parco delle Risaie

Natural Path - Large vision. scale 1:5000


Santa Rita
Sanctuary
sport fields
Swiming pool
Sport field
Sport complex
Private vegetation
patches
Parco Andrea
Campagna
Parco delle Risaie
PARCO AGRICOLO SUD


Lorenteggio
San Cristoforo Station
Naviglio Grande
Via Lodovico il Moro
Via Martinelli
Church San Silvestro
Via Beltrani
Via Merula
Scolmatore Olona
Farm
Natural Path - Contextual vision
1km
5km
N
Project area
Dwelling
Relevant buildings
Water
Private garden
Public green area
Agricultural field
Potential green corridor


Church Santa
Maria
Ausiliatrice
Day Center
Supermarket
Via Giussani
Via Pepere
Sport field
Via Ponti
Farm
Parco delle Risaie

DESIGN

DEFINITION

As largely stated before, the critical reading of theories selected through a bibliographic approach in *Part 1 - Learning from the Past*, brought to a **personal definition of tectonic as the architecture that is sensuous, functional and permanent**. Moreover, it underlined that **the dwelling space that is comfortable, authentic, and flexible is most likely perceived by users as home, the place-identity**. The present section of the thesis is devoted to define a design strategy for Ronchetto S/N that creates tectonic architecture to dwell. Hence, it aims to design a new place in Milan in which citizens can recognize them-selves and feel home.

Tectonic approach

The theoretical research done in *Part 1* concluded that in order to obtain a tectonic result is necessary to apply to the design all the strategies concerning comfort, authenticity, and flexibility, that are: sense involvement, optimization, reduction, link with traditions, and consideration to changes (see *Synthesis*, pages 97-103).
These strategies will be here applied to the case study of Ronchetto S/N through a reflection since the first phases of the design process on dimensions, materiality, disposition, adaptability, multi-functionality, extendibility, form, distribution, and outdoor space organization of the architectural space.

Sustainable approach

Particular attention will be given at both urban scale and apartment scale to the social and environmental sustainability of the project. In line with the theories summarized in the chapter *Permanence and Authenticity* (pages 59-71) it is my personal consideration that an architecture cannot be successfully sensuous, functional, and permanent without studying the social and environmental impact of the built space in the realm.

Toward the definition of a specific program

Applying this general understanding of tectonic and the given personal definition of home to the case study of Ronchetto S/N, analysed in its existing condition in the previous chapter, it is possible to define a **specific design program** for the site. This program has to take into consideration the requests of the Municipality of Milan (described at page 127) and completes them through the clear statement of a vision for the area, that describes the emotional qualities aimed onto the new urban environment. Starting from the vision definition, it will be consequently possible to pin point the functions that will be present on the new area and describe the design principles that will be applied to the architecture in order to obtain the expressed spatial gesture.

SPECIFIC PROGRAM DEFINITION

Toward a future sensuousness of the space

The theoretical research done in the first phase of the present thesis combined with the requests of the Municipality of Milan concerning the future development of Ronchetto S/N described in the last chapter allowed me to define a spatial idea for the new dwelling complex.
The studies on the themes of Sensuousness and Comfort done at pages 35-57 through the reading of Semper, Teige, Cranz, Pallasmaa, and Loos and supported by the theories of Vitta and others summarized from page 25 to 30, brought me to the will to **design places composed by spaces with different characters**. Thinking about families, in particular my personal analysis of Vitta's and Teige's researches emphasized the importance to **provide each inhabitant of a private space, but also to encourage certain shared activities** both at the urban and at the apartment scale. Consequently I aim to design in Ronchetto S/N an urban space that **encourage public gathering without deprive flats inhabitants of their privacy**; I also aim to create a dwelling complex in which there are **public facilities** and apartments in which each family component feel to have an **intimate and personal space**. In this direction, the studies done in the chapter *Sensuousness and Comfort* were fundamental in the present thesis in order to understand that the definition of **architectural details can emphasize the gesture of the space**. The **users' sense involvement** engages indeed their minds suggesting cosiness, majesty, or other feelings. Therefore I claim for Ronchetto S/N the design of indoor and outdoor spaces that use **materiality, dimensions, and dispositional strategies as design principles to create comfortable spaces and involving dwelling experiences**, meeting function and poetic of the architecture.
The reflections on the theme of Authenticity done at pages 59-78 through the reading of Teige, Frampton, Hvattum, Kaplan, and Ando brought me to the will to **create in Ronchetto S/N a place in which natural and artificial environment are mixed and integrated one to each other**. The chapter *Permanence and Authenticity* underlined indeed that the presence of natural elements in the urban environment could increase the sensuousness of the indoor spaces reducing in the same time inhabitants' mental fatigue. In particular, the examples of Nordic architecture described by Hvattum (2012) and of Ando's Rokko Housing (see pages 72-78) underlined how it is possible to create the territory as a whole by **emphasizing both natural and artificial elements** in it. Approaching in

this way the project of Ronchetto S/N, **the new dwelling complex and the apartment units will be perceived as part of the city of Milan**. Furthermore **nature will be shown in innovative ways to visitors, encouraging them to discover it and live it**, meeting the requirements of the Municipality. Finally, the in-depth analysis of the theme of Permanence done in the first part of the present report emphasised from page 79 to page 95 the necessity to provide a certain amount of flexibility to buildings in order to respond to time changes and persist on the landscape as long as possible. The interpretation of Leupen's, Fawcett's, Ando's, and Holl's theories were in this case fundamental in order to define the goal of designing new apartments in Ronchetto S/N that not only **reflect contemporary uses of the home-space**, but also **aim at adapting to future inhabitants' needs**. The project of the new dwelling area would consequently gain a higher **strategic spirit** allowing certain **temporary transformations of the internal spatial layout**.

Vision

In conclusion, it is possible to synthesize my personal vision for the development of the area of Ronchetto S/N as the will to **link entities in a constant game between past, present, and future**. **Architecture becomes the tool to guide users toward the discovering of the place they live in its complexity and totality**.

General vision for Ronchetto S/N. The diagram diagrammatically represents the will to guide users toward the discovering of the place the live through architecture.

From vision to design

Summarizing what stated in the previous lines, my personal vision for the new dwelling complex in Ronchetto S/N previews three main classes of action:

1. The creation of an urban environment dedicated to families;
2. The stimulation of a new kind of urban life that includes nature;
3. The creation of a link between new complex and Milan.

The first point implicitly includes secondary design strategies, such as:

- The encouragement of the permanence of inhabitants in the apartment units;
- The design of apartments that suit people of all ages and are affordable also by youth;
- The guarantee of comfort space for inhabitants, meaning that locales will be sized according to functions reducing wastes and defined in their details according to the sensuousness sought.

Just in the same way, the stimulation of a new kind of urban life that includes nature cross-refers to:

- The integration between indoor and outdoor dwelling spaces;
- The mix of uses and functions onto the new landscape;
- The promotion of public activities.

Finally, it is possible to underline that the will to link new and old in Milan could be translated as the will to create new buildings starting from the characteristics of the existing.

Users definition

In order to develop the points above, it seems clear to me that is firstly necessary to define the families that I want to address to. The analysis of the existing conditions of Milan concerning family structure underlined that:

- 59% of the population is organized in families generally composed by 3 or 4 members and rarely more;

- 53% of the population of the city lives in groups of 2 people;
- 78% of the population own the apartment in which it live.

Taking those data into account, the project for a future dwelling complex in Ronchetto S/N will especially address to **families up to 4 members**. Nonetheless the reading of information regarding apartment prices compared to the average salary underlined the difficulty, especially for young people, to emancipate from the original family (page117). Therefore the project will consider the internal subdivision of the nucleus into **smaller groups in time**. This will mean that **the designed apartment units will be thought to be sold as a whole**, but they will be able to adapt in time and **change the internal layout dividing the internal space in smaller flats**. In this way, the apartments will be able to host the families that live in them for all their life, from when they initially constitute their nucleus parents+children until sons grow up and need a separated accommodation and parents become old needing a guest room for nurses or grandsons.

Outdoor space typologies definition

Wanting to stimulate a new urban life-style that includes nature, it is interesting to look at the data collected during the analysis concerning the actual urban structure of Milan:
- 76% of the dwelling buildings in Milan host more than 16 family units;
- Around the project area of Ronchetto S/N dwellings have an average of 7 floors;
- In average, each Milanese has the access to 16,1 m^2 of green space and 23, 8 m^2 of built space;
- Dwelling surrounding the project area are mainly organized in courtyards;
- The project area is actually occupied by woods and it adjoins toward South with Parco Agricolo Sud

The new project will take into account the present density of Milan, but will try to improve the urban quality **increasing the average green space accessible per person**. The traditional typology of courtyards works perfectly in line with this goal, and will be for this reason applied to the new buildings. Moreover, the new building will propose dwelling solutions with access to outdoor spaces with different levels of privacy: **terraces and balcony** will be given to the private use of the single family units; the **common courtyards** will be used by neighbours from the same building complex; a **park and a system of squares** will gather people from the surrounding areas. Furthermore, since the actual urban development of Milan adjoins the project site toward North, the new settlement will be **more dense in the North** part of the area and **more natural toward South**. As a result, the new project will **integrate natural and artificial landscape** in order to create a new whole **respecting the existing layout of the city** but implementing it with new strategies.

Urban functions

The reflection on the outdoor urban spaces is linked to the study on the urban function that should be present in the new settlement. As underlined through the analytical description of the chapter before, the surroundings of the project area present mainly dwellings, but also cultural and natural sites such as Churches, sport fields, the Parco delle Risaie, Villa Beltrani, a kindergarten, and a day centre. More specifically, the analysis underlined that:
- The cultural sites are mainly organized along a path that crosses the site from South-West to North-East;
- The natural and sportive sites draw a path that crosses the site area from North-West to South-East.

The new urban organization will respect these two paths and implement them thanks to the **distribution of public facilities** and the **definition of new routes** along those directions. Within the cultural field, the project will include an **elementary school**. For what concerns the sportive field, the new design will include a **sport centre**, link between urban and natural environment. In this way, the connection between the new Ronchetto S/N quarter with Milan city centre will be completed.

Finally, wanting to promote the active use of the new urban spaces, other functions will be diffused on the site, such as **shops and offices**. This strategy will allow inhabitants to live the neighbourhood and potentially live closer to their working place. Clearly, the distribution of activities among the site will also determine the configuration of distribution paths, squares, parking areas, and public green areas.
Dwellings will be position in such a way that the public activities will not disturb the internal use of the private space. In other words, there will be a **buffer between private dwelling space and public one**.

DESIGN PRINCIPLES

In the lines above, the description of the new project program already defined some design principles. The following table visualizes the link between stated goal, class of principles extracted from he theoretical part of the present critical essay (dimensions, materials, disposition, form, distribution paths, and organization of the outdoor spaces, variability, multi-functionality), and translation of those general class of principles into actions to apply to future project.

Table of the relationship between vision and design principles.

Goal	Principle investigated	Action
guarantee of comfort space for inhabitants	dimensions	locales will be sized according to functions reducing wastes
guarantee of comfort space for inhabitants	materiality	locales will be defined in their details according to the sensuousness sought
guarantee of comfort space for inhabitants	disposition	Create at a urban scale a buffer between private activities (dwellings) and public ones (services and public facilities)
create new buildings starting from the characteristics of the existing	disposition	Organize the new urban activities along the existing paths, which have a cultural and a sportive character
create new buildings starting from the characteristics of the existing	form	Apply at the new buildings the typology of courtyard
promotion of public activities	distribution	Organize public functions along strategic paths and around squares
integration between indoor and outdoor dwelling spaces	Outdoor space organization	Diffuse on the territory different kinds of outdoor spaces, such as terraces, courtyards, park, and public squares respecting the public or private vocation of each
encouragement of the permanence of inhabitants in the apartment units	variability	the designed apartment units will be thought to be sold as a whole, but they will be able to adapt in time and change the internal layout dividing the internal space in smaller flats
mix of uses and functions onto the new landscape	multi-functionality	Different kinds of functions will be present in the new urban settlement. Besides dwellings there will be a new sport center ,an elementary school, workshops, study rooms, offices, and restaurants.

In the following paragraphs these principles will be translated in a urban and apartment concept.

CONCEPT

Urban concept

The design principles defined in the previous pages brought to the definition of an urban concept that previews to superpose on the landscape a cultural and a natural layer. Dwellings will build around the three fields in a reciprocal support.
The cultural paths will have a main direction from West to East (as already shown at pages 130-131) **connecting the historical Villa Beltrani with a new elementary school, the existing kindergarten, and the day centre**. **The natural path** will have a main direction from North to South (shown in the pages 134-135) and **will connect different kinds of green urban areas with a new sport centre completed by football field and ending into Parco delle Risaie**. In the next page, a preliminary study of the urban disposition of buildings is proposed in order to understand the new project will densify the area. The visualization belongs from the studies done at page 126 and cross-checks the municipality quantity indications with the vision previously defined. In this case, buildings organize themselves in courtyards and are more dense in the North part of the site in order to respect the existing urban conformation. It is possible to notice that differently from the diagrams at page 126 the new urban layout here proposed starts creating differentiated urban spaces organized in a fluid sequence that encourages visitors wandering. Nevertheless, the total built floor area of 80000 m^2 and the number of floors per building did not change, staying below 5 fllors per building.

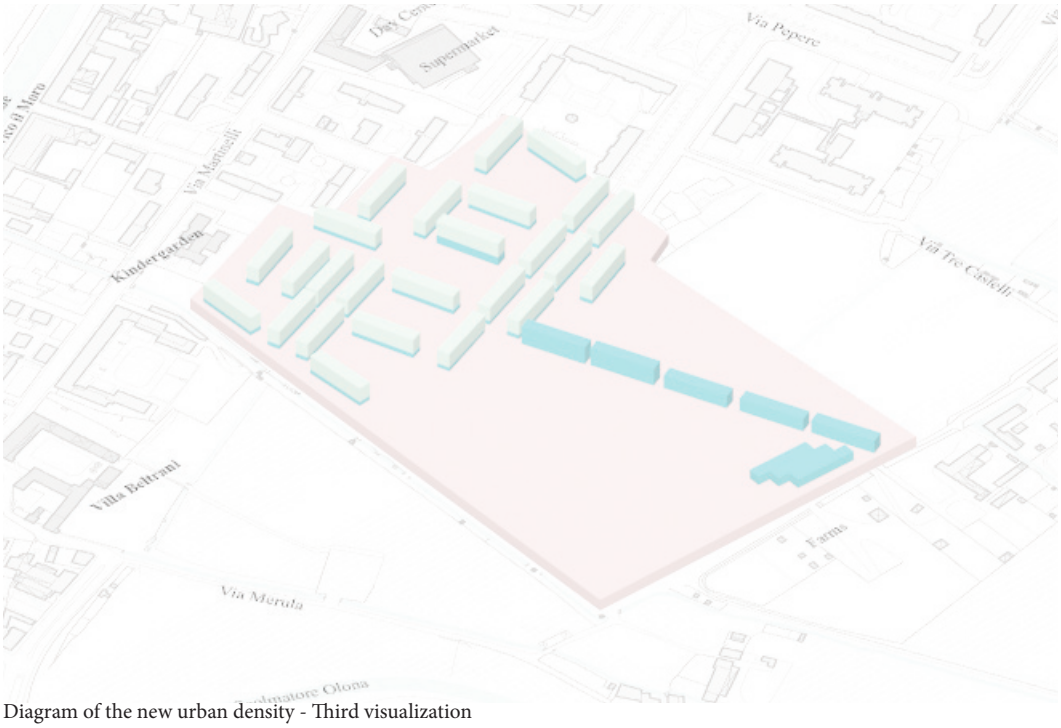
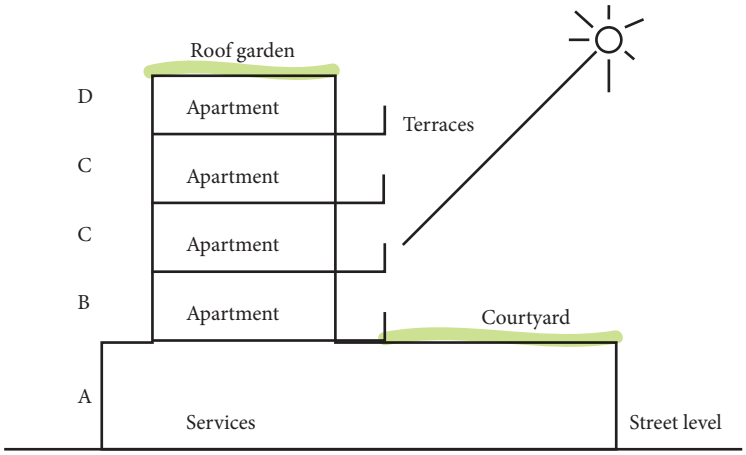


Diagram of the new urban density - Third visualization

- Project area
- Dwellings
- Services

Building concept

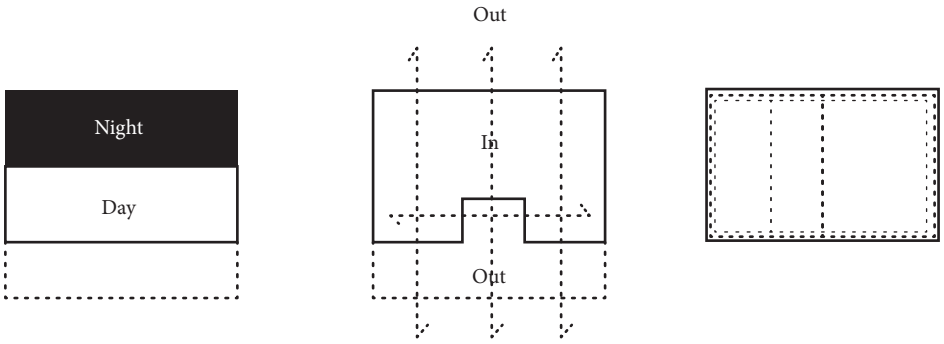
At the building scale, the mixture of functions required by Milan will be guaranteed, but respecting the need of privacy of users according to each activity. At the ground floor it is preview a layer of public services for inhabitants and neighbours (see diagram below), while on the top floors there will be space for the private flats. Moreover, the courtyards will be put at a higher level than the street, so that the semi-public soil will constitute a second layer of the ground.
Also at the building scale different kinds of outdoor space will be provided to inhabitants according to the position of the apartment in which they live. The first floor of dwelling units (Typo B in the diagram below) will have direct access to a private large terraces and to the courtyard, the middle floors (flat typology C in the diagram below) will have smaller terraces, while the last floors (Typo D) will also be provided of private roof gardens. At this scale the vision of linking entities and guiding through architecture will be further developed detailing pedestrian paths and courtyard in order to direct users flows and views. The orientation of the buildings will be done according to sun path and view toward outside.



Apartment concept

The apartments follow a similar approach to privacy and are thought to have different nucleus with peculiar functions and intimacy level. The division between day and night activities will be the first strategy applied in this direction. Each member of the family will be invited to gather in some common areas, but will also have a very private space for sleeping and read. Moreover, wanting to underline also at the apartment scale the link between artificial and natural landscape, a continuous relationship between indoor and outdoor space will be guarantee. This relationship will be both visual and physical, allowing in some cases the extension toward outside of the indoor activities. Finally, further reflections will be done on the flexibility of the interior spaces, providing variability

to the dwelling units that will not influence the functionality of locales.
The diagrams below briefly describe the apartment concept.



Functional division

Relationship between inside and outside

Variability of the internal layout

In the next chapter the spatial concept will be further developed and will define the final design of the project for Ronchetto S/N.

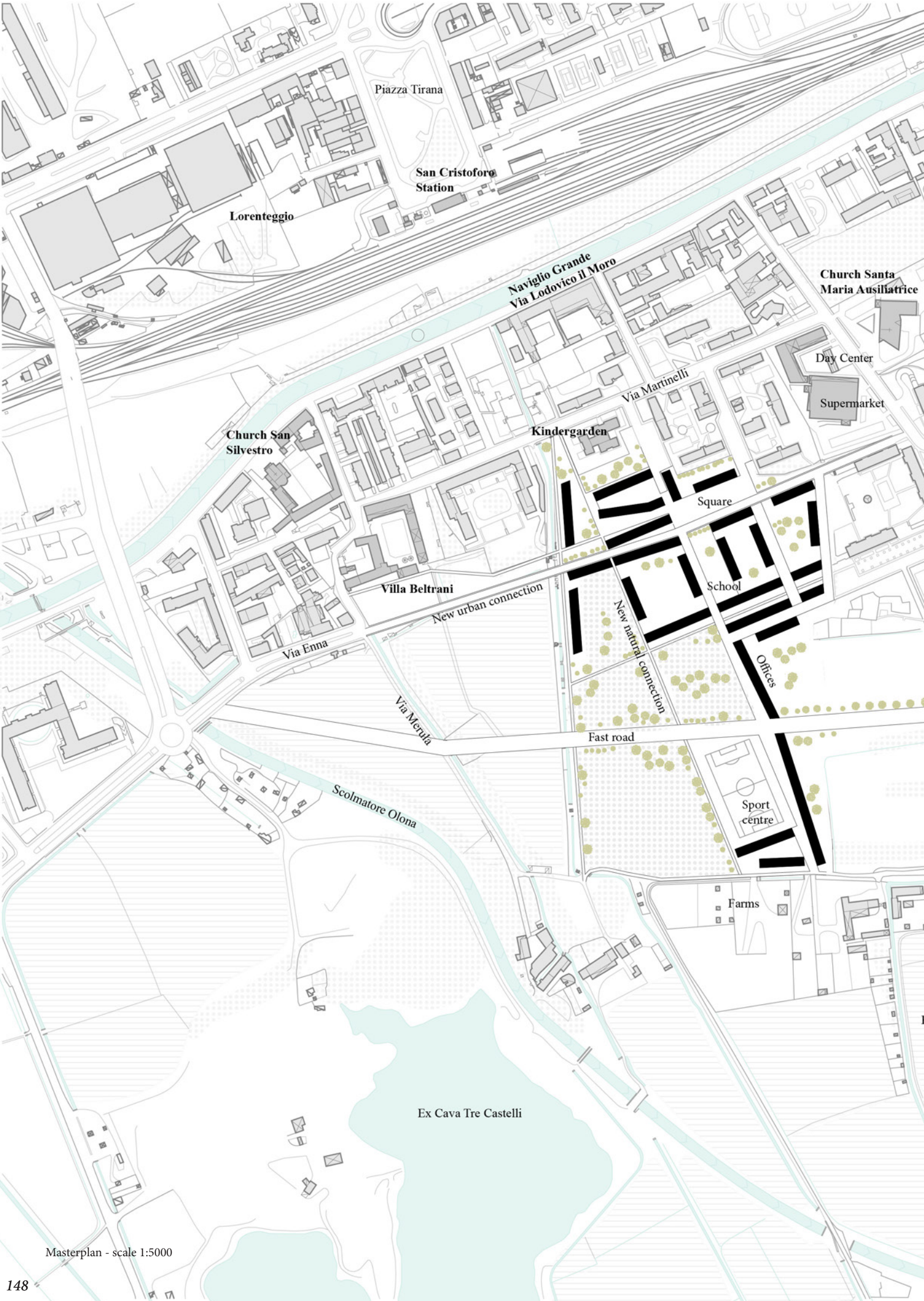
DESIGN

PRESENTATION

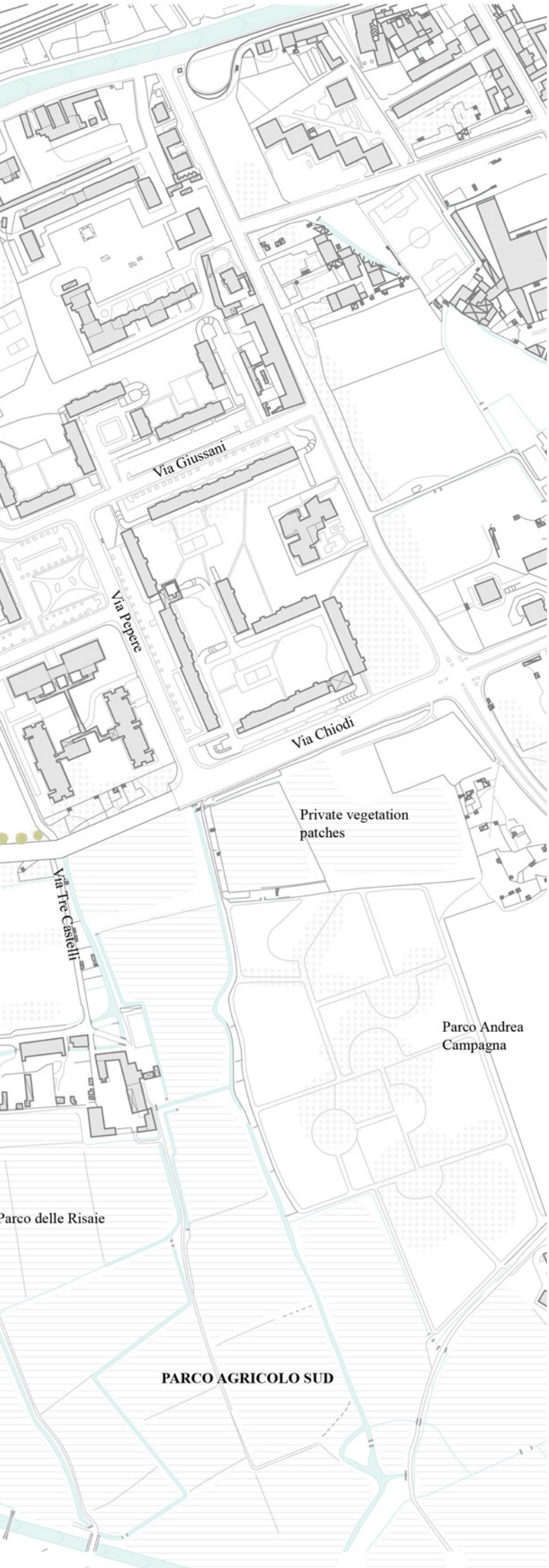
The present chapter of the thesis is devoted to present the proposed project for a new dwelling complex in Ronchetto S/N.
As mentioned earlier the project has been defined combining the theories developed in *Part1 - Learning from the Past* with the analysis of the previous chapters of *Part 2 - Designing for the Future* and aims to create a new place in Milan in which citizens can recognize them-selves and feel home.
Therefore in the next pages the reader will find a collection of drawings oriented to the illustration of the proposal.
Starting from the urban scale, it will be possible to read how the vision defined at page 140 and the concept (pages 142-144) have been translated in a programmatic masterplan, which considering the extension of the site recommends to develop the new complex in three different phases (page 149).
The masterplan clearly recalls the diagram at page 143, but starts moving the building and modifying their dimensions in order to adapt them to the context breaking the repetitiveness of the program.
Consequently the project focuses on the first phase of urban development (pages 150-151) and more specifically defines the design of a central complex of buildings (from page 152). The building definition continues to reduce the monotony of the masterplan with the aim of creating an interesting dwelling experience for inhabitants and an involving 'journey' for visitors.
Finally the design will focus on the apartment and detail scale describing sensuousness, functionality, and durability of the home-space (from page 154).

DESIGN PROCESS

Although the present chapter collects the drawings of the final proposal mainly proceeding from the largest to the smallest scale, it is important to underline that in the design development the process was often inverted in order to control the relationship between urban, building, and apartment design.
More precisely wanting to design 'homes' the project started from a study at the apartment level, defining a general scheme for the internal layout that reduced the locales dimensions to the minimum but creating sensuous and flexible spaces. The apartment designed in this way has been treated as the basic template from which to begin developing the building layout, thus starting to give shape to the new urban environment. Only at this point was possible to focus specifically on urban and building scale, transforming the initially rigid scheme and creating a more coherent and fluid environment.
Hence at this point the study of the larger scale influenced the smaller one, modifying also substantially the apartment initial template. Nonetheless, the template was fundamental in order to define gesture and principles of the space, which have always been respected if not emphasized in the final design of the dwelling experience (see pages 162-165).

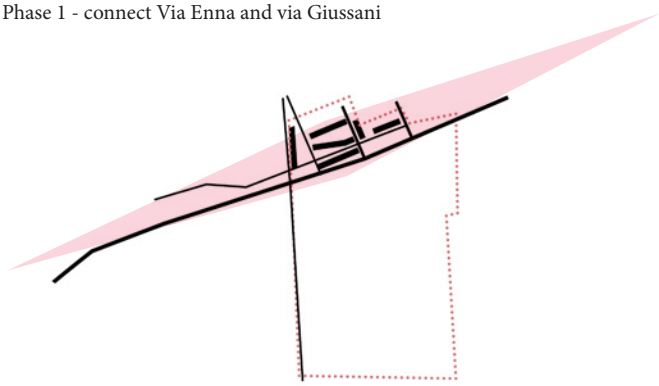


Masterplan - scale 1:5000

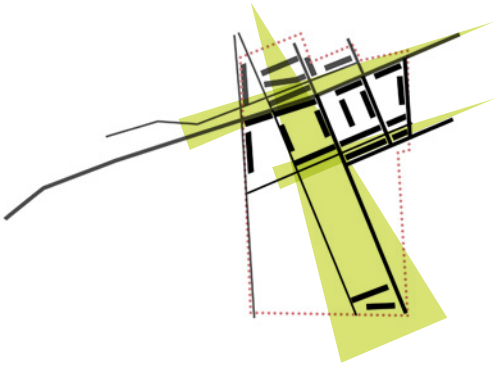


PHASES OF DEVELOPMENT

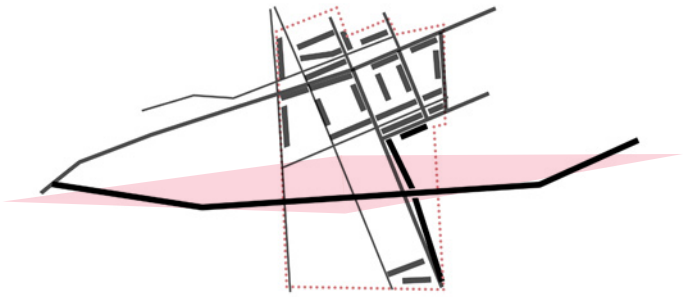
Phase 1 - connect Via Enna and via Giussani



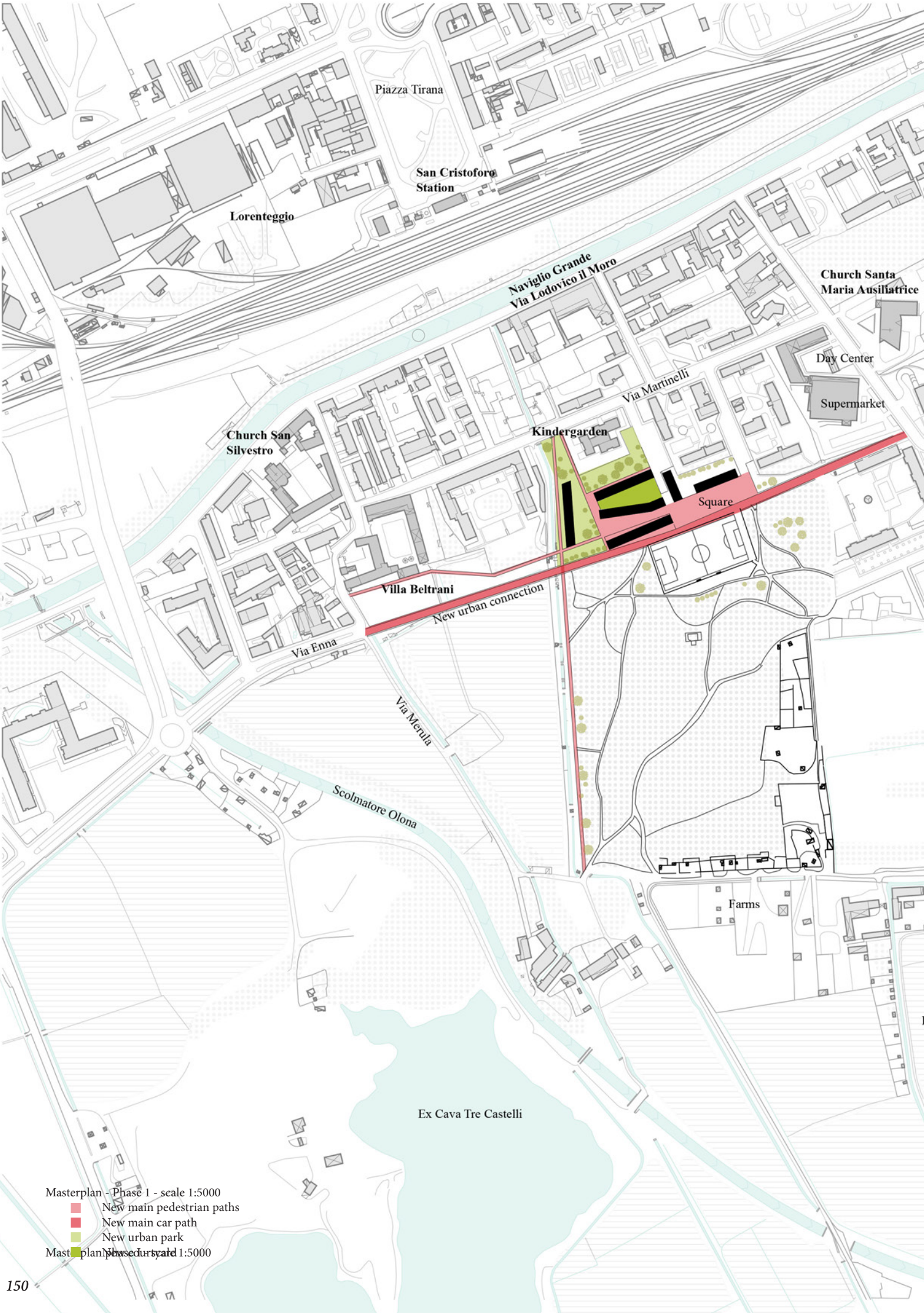
Phase 2 - complete Parco delle Risaie and connect it with the city centre

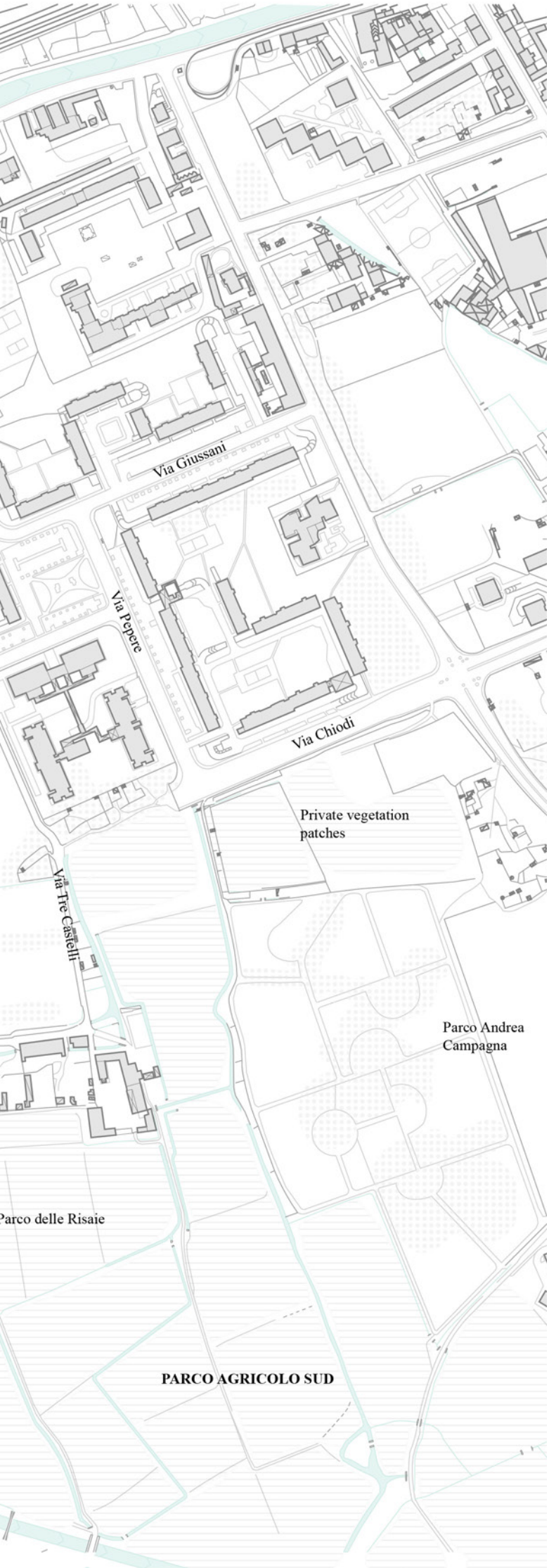


Phase 3 - connect via Merula and via Chiodi



Masterplan development - the diagrams show how the masterplan could be developed in three different phases. This strategy will allow to give the architectural design to different architects, providing diversity to the site. Moreover, proceeding by steps the municipality could verify in time the changing necessity of the area and eventually adapt the urban strategy.


Piazza Tirana
San Cristoforo Station
Lorenteggio
Naviglio Grande
Via Lodovico il Moro
Church Santa Maria Ausiliatrice
Day Center
Supermarket
Via Martinelli
Kindergarden
Church San Silvestro
Square
Villa Beltrani
New urban connection
Via Enna
Via Merula
Scolmatore Olona
Farms
Ex Cava Tre Castelli
Masterplan - Phase 1 - scale 1:5000
New main pedestrian paths
New main car path
New urban park
Masterplan - Phase 2 - scale 1:5000



PHASE I

Goals:

- Creation of the **connection axis between Via Giussani and Via Enna**;
- Re-qualification of the **path connecting via Martinelli and Parco Agricolo Sud** overlooking the river at the West border of the site area;
- Keeping at the maximum level possible of the **public and pedestrian vocation of the site**;
- Creation of **new buildings for a total amount of 15000 m²**;
- Connection between Villa Beltrani, Kindergarden, and Day Centre through the creation of a **new pedestrian path**;
- Provision of **services and common facilities** to dwellings;
- Considering the **future development** of the site in the building design.

Actions:

- Re-qualification of the urban parc facing Via Martinelli;
- Definition of a built front for the new car path connecting Via Enna and Via Giussani;
- Definition of a public square to support and enrich the new cultural path;
- Definition of a pedestrian path connecting Villa Beltrani and the new square;
- Creation of public areas with different vocations to encourage the use of the outdoor spaces by citizens;
- Provision of private parkings and storage space to dwellings;
- Guarantee a distance between private and public space in order to provide the proper privacy to inhabitants;
- Integrate existing buildings with new urban development.

Urban plan - phase I - Ground Floor - scale 1:500


Common storage
Cellars
Public square
Shop
Cellars
Com
mon
room
Shop
Public parking
Shop
Pre-existing football field

Family Apartment Template

Courtyard
(+3,00 m)

Street
(±0,00 m)

Template apartment plan - first floor - scale 1:100 N

As stated since the design definition (pages 137-144) the present project for a new dwelling complex in Ronchetto S/N focuses at the apartment level on the creation of flats suited for families of 4 members. In the paragraphs dedicated to the design process description (page 147) it has been described how the single apartment distributed on the site have been designed starting from a template. The template is therefore here taken into analysis in order to describe the common characters of all the flats, even if in the reality of the final project each of them has been modified according to its position in the context (further explanations on this subject will be given from page 162).

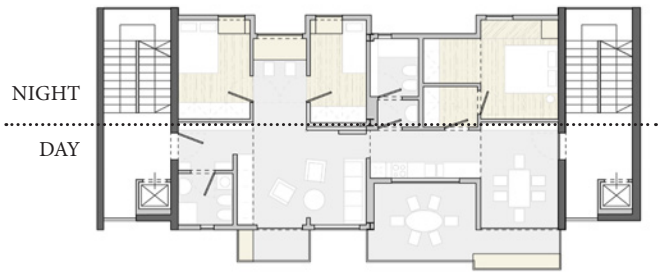
From the plan in the previous page and the diagrams on the side it is possible to notice how the template flat organizes the dwelling spaces dividing day activities (facing North-West) from night ones (facing South-East) and underlining their vocation through the use of materials (in line with Ando's and Loos' indications, studied in the first part of the present thesis): living and service areas have a hard flooring, while the sleeping ones have a wooden flooring, softer and warmer.

From the structural point of view, the staircases are treated as statical elements, supporting the apartment and allowing the reduction at the very minimum of the number of columns (see appendix 4).

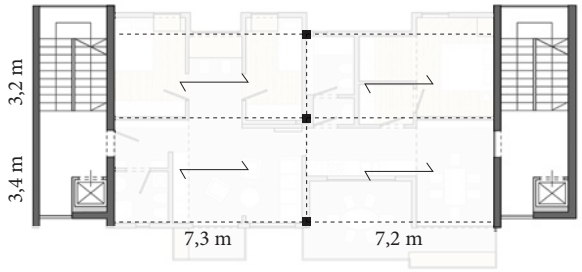
Further reflections have been done on the service areas, which are condensed in two nucleus: one at the main entrance, and one in the centre of the flat. These areas will have a lower ceiling, allowing from one hand to host pipes and technical equipement, and on the other hand creating a game of compression and expansion of the internal journey belonging from Loos' Muller House (see pages 50-57). Specifically this character of the flat will be further described at page 158.

Important reflection has been done also regarding visual and physical connections between inside and outside. Embracing Ando's example (see pages 72-78) the template proposes to expand large part of the living areas toward outside through the provision of balconies and terraces divided from the indoor locals by large windows. In this way, the boundaries between indoor and outdoor space are blurred and, especially in the warm season, can be completely deleted. Concerning windows positions and dimensioning, particular attention has been also given to the provision of the proper amount of daylight to the different indoor spaces (see Appendix 5).

Finally, the plan development of the apartments composing the building complex was influenced by Holl's study (third case study of *Part 1*). The flat indeed is designed in such a way to allow the changes in time. Originally presented as an apartment for a family of four members, a system of movable partitions allows inhabitants to modify the internal layout configuration in order to create different apartment units for one, two, or three members. In the next page, the different internal configurations are presented in plan.



Distribution - Division between living and sleeping activities



Distribution - Structural scheme

Distribution - Organization of service nucleus

Outdoor organization and extendibility - Connections between indoor and outdoor spaces

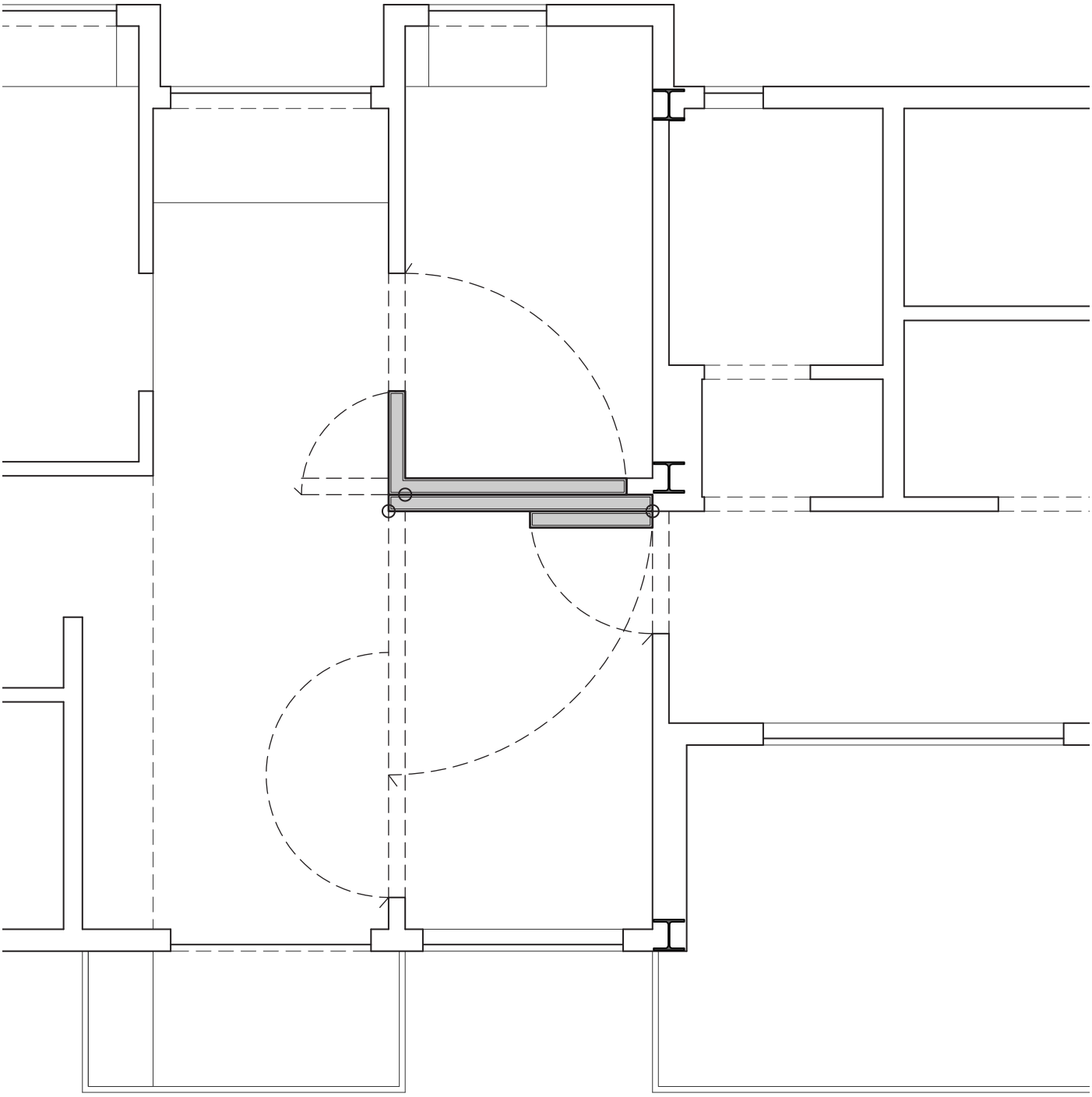
Apartment for two singles - 61,7 m²

Apartment for a couple - 66,2 m²

Apartment for a single - 43,21 m²

Apartment for a couple and guest - 84,7 m²

Template apartment plan - internal layout transformations - scale 1:100 N



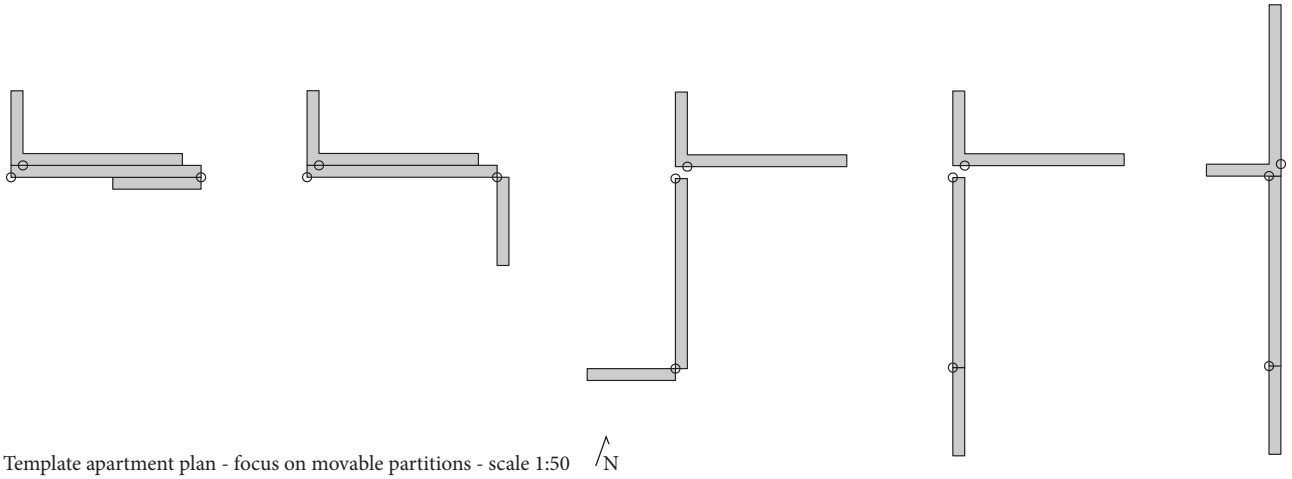
Position 1
Layout 1

Position 2
Layout 2

Position 3
Transitional layout

Position 4
Transitional layout

Position 5
Layout 3



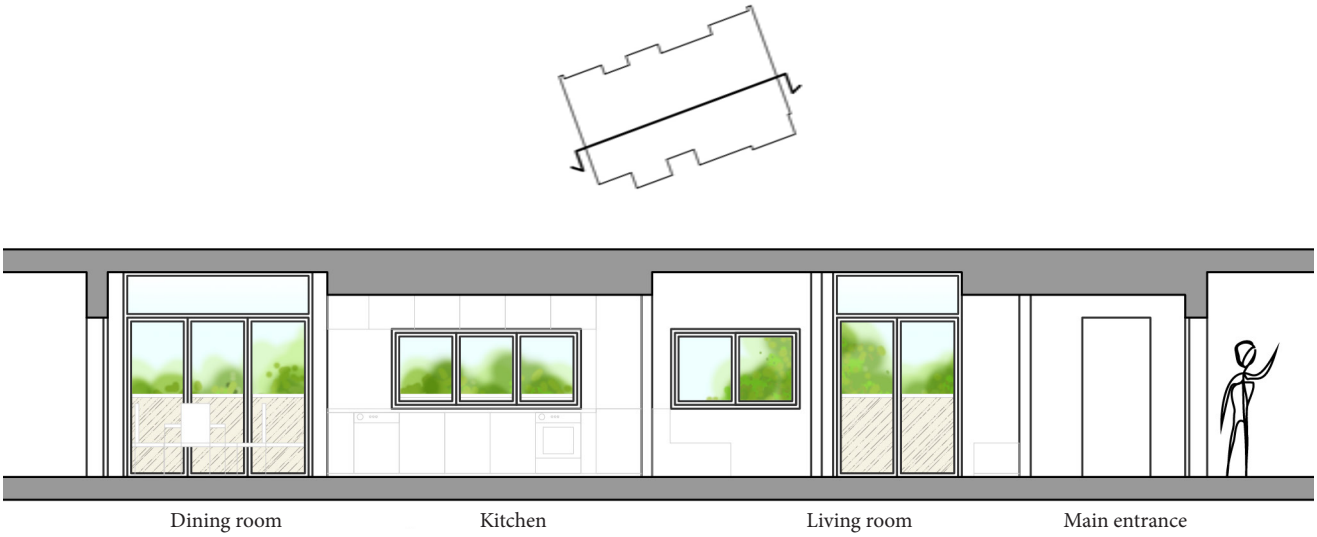
Template apartment plan - focus on movable partitions - scale 1:50

N

The living area

The disposition of the rooms composing the living area, illustrated in the section and diagram below, follows Loos' teachings (see first case study). From the main entrance toward the dining room, crossing living room and kitchen area, visitors are indeed guided toward spaces that contract and expand in succession, emphasizing the differences between them.
Service spaces have a lower ceiling and a smaller surface, while more convivial areas are larger and taller.
Furthermore, the space embrace Ando's indications regarding the necessity to link citizens with the outdoor environment (see second case study). Living area and dining room are therefore in direct connection with the terraces and in visual connection with the courtyard toward the studio. This strategy will once again visually enlarge the dimensions of the rooms underlining their vocation for gathering.

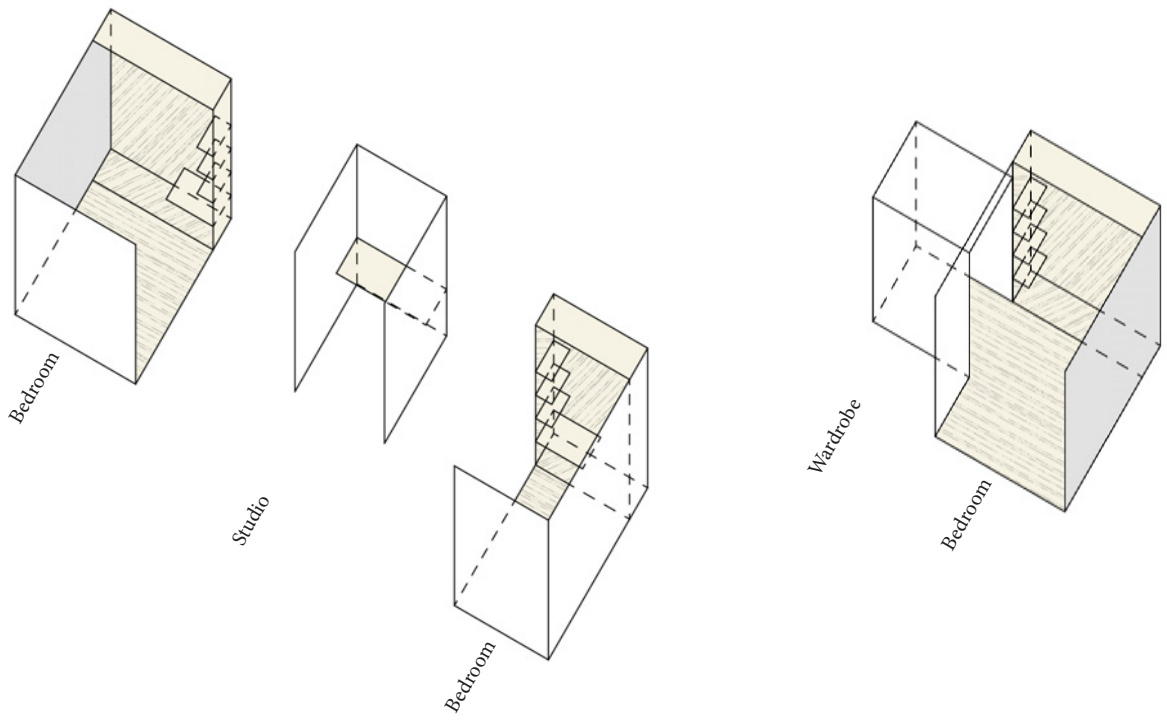
Dimensions and Disposition



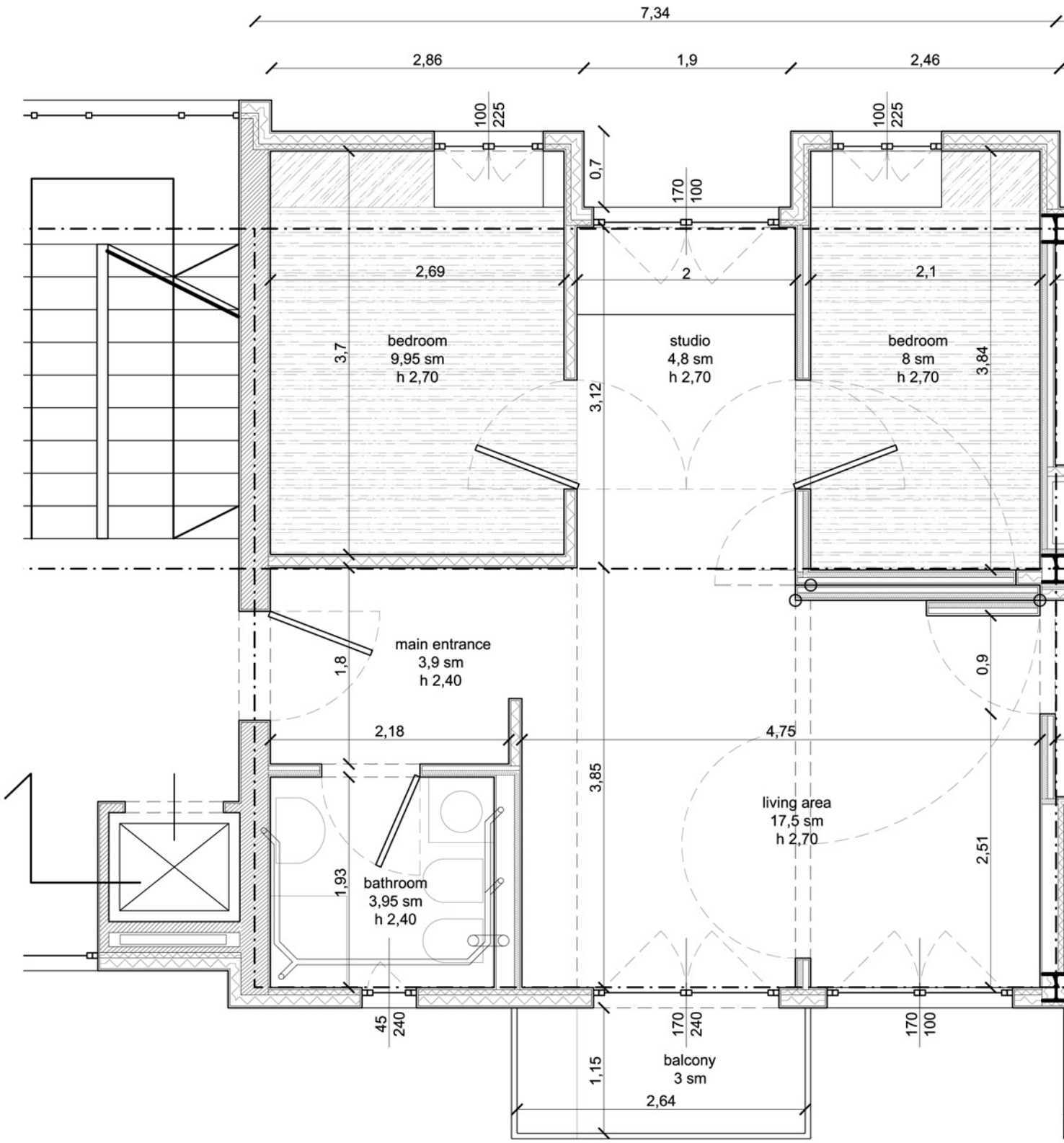
Template apartment - section 1:100 and diagram of dimensions and disposition of the living spaces
Spatial extension toward outside

The sleeping area is divided in nucleus (children bedrooms and master bedroom) in order to provide inhabitants of the proper privacy.
The two children bedrooms are unified by the studio area, that is in common and faces the living room. The master bedroom on the other hand is completely independent and declined in bed space and wardrobe.
Nonetheless, similarly to what happens in the living area we can notice how the service spaces have a lower ceiling and a smaller plan dimension. Moreover, materials underline the vocation of the space also in elevation, defining cosy nooks, ultimate space of intimacy.
Clearly the composition of the walls have been defined in order to also respect the Italian standards, as it is readable in the Appendix 6.

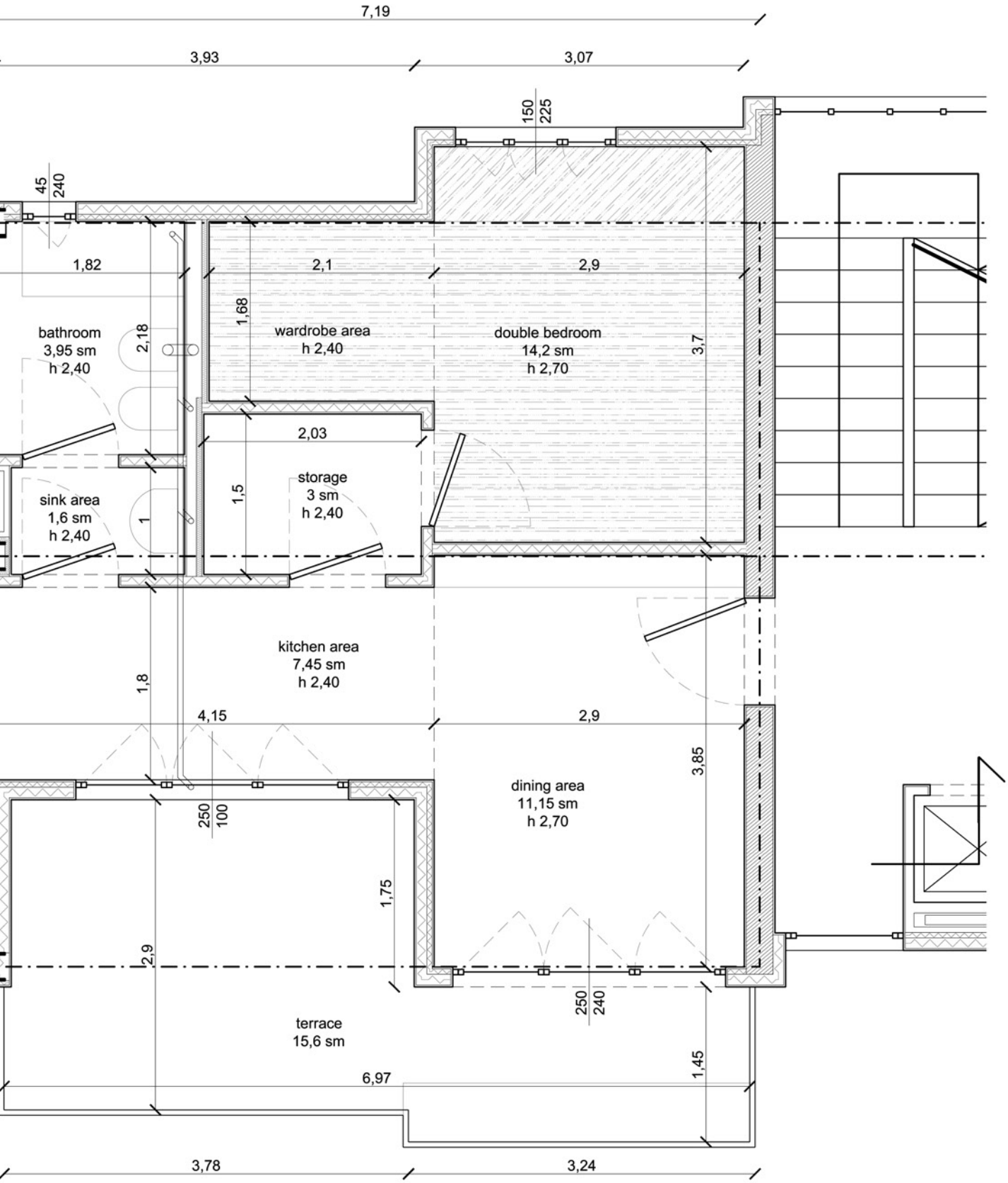
Dimensions and Materiality



Template apartment - section 1:100 and diagrams of materiality of night area
- Concrete
- Plasterboard
- Wood



Template apartment plan - scale 1:50 N

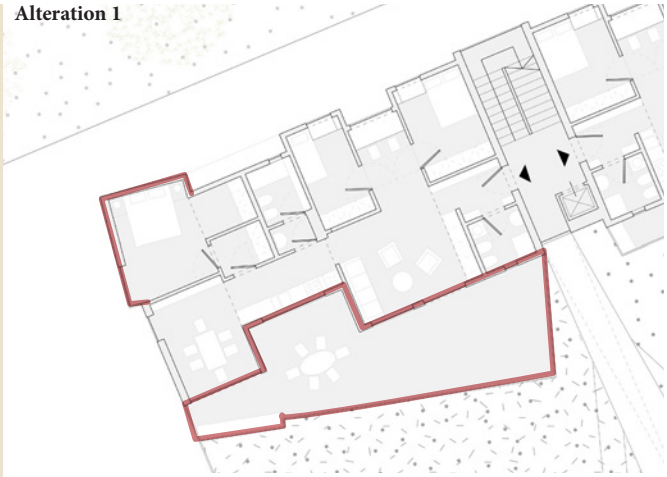

7,19
3,93
3,07
150
225
45
240
1,82
2,1
2,9
1,68
bathroom
3,95 sm
h 2,40
2,18
wardrobe area
h 2,40
double bedroom
14,2 sm
h 2,70
3,7
2,03
storage
3 sm
h 2,40
1,5
sink area
1,6 sm
h 2,40
1
kitchen area
7,45 sm
h 2,40
1,8
4,15
2,9
3,85
dining area
11,15 sm
h 2,70
250
100
1,75
2,9
250
240
terrace
15,6 sm
1,45
6,97
3,78
3,24

Apartment Alterations at the First Floor

Urban plan - phase I - First Floor - scale 1:500
Colours refer to the type of alteration of the apartments, further described in the next pages.

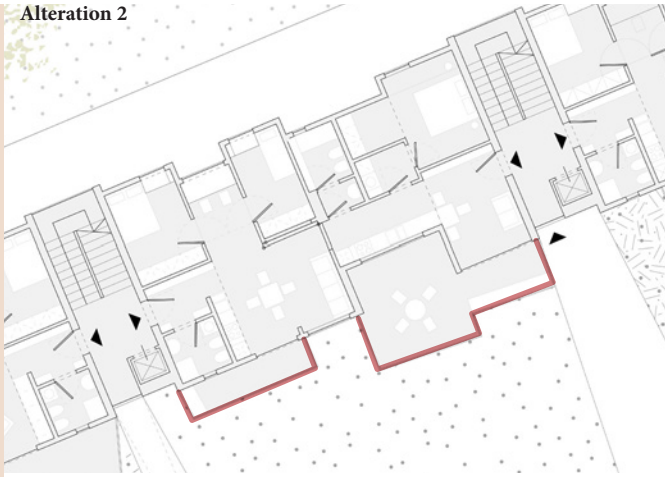

A'

Alteration 1



Variability: degreased to allow view toward West
Outdoor spaces: increased
Dimensions of the indoor spaces: unchanged

Alteration 2



Variability: unchanged
Outdoor spaces: increased
Dimensions of the indoor spaces: unchanged

Alteration 5

Variability: unchanged
Outdoor spaces: increased
Dimensions of the indoor spaces: unchanged

Alteration 6

Variability: unchanged
Outdoor spaces: unchanged
Dimensions of the indoor spaces: changed - larger master bedroom

Alteration 9

Variability: unchanged
Outdoor spaces: increased
Dimensions of the indoor spaces: changed - larger single bedroom.

Alteration 10

Variability: degreased
Outdoor spaces: increased
Dimensions of the indoor spaces: changed - reduction of the unit at a single apartment module.

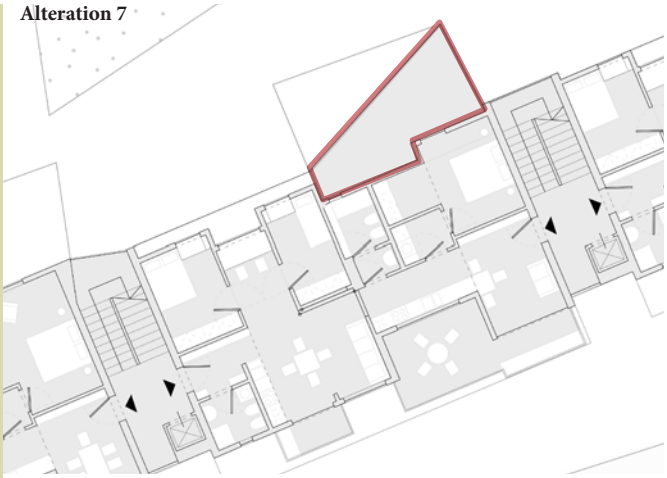
Alteration 3

Variability: degreased to allow back gardens
Outdoor spaces: increased
Dimensions of the indoor spaces: changed - larger bedrooms and smaller dining room.

Alteration 4

Variability: degreased to allow back gardens
Outdoor spaces: increased
Dimensions of the indoor spaces: changed - larger bedrooms and living area

Alteration 7

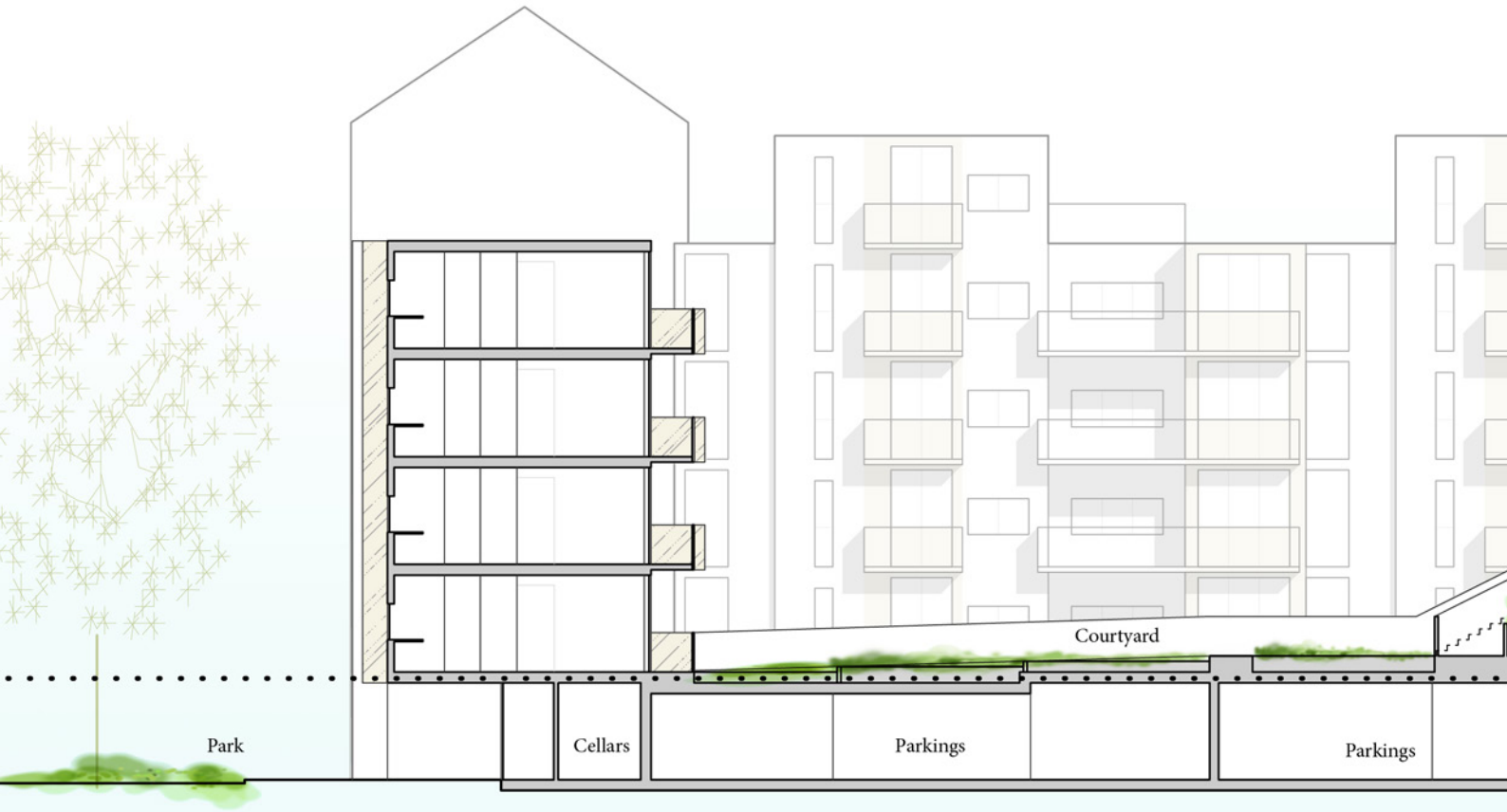


Variability: unchanged
Outdoor spaces: increased
Dimensions of the indoor spaces: unchanged

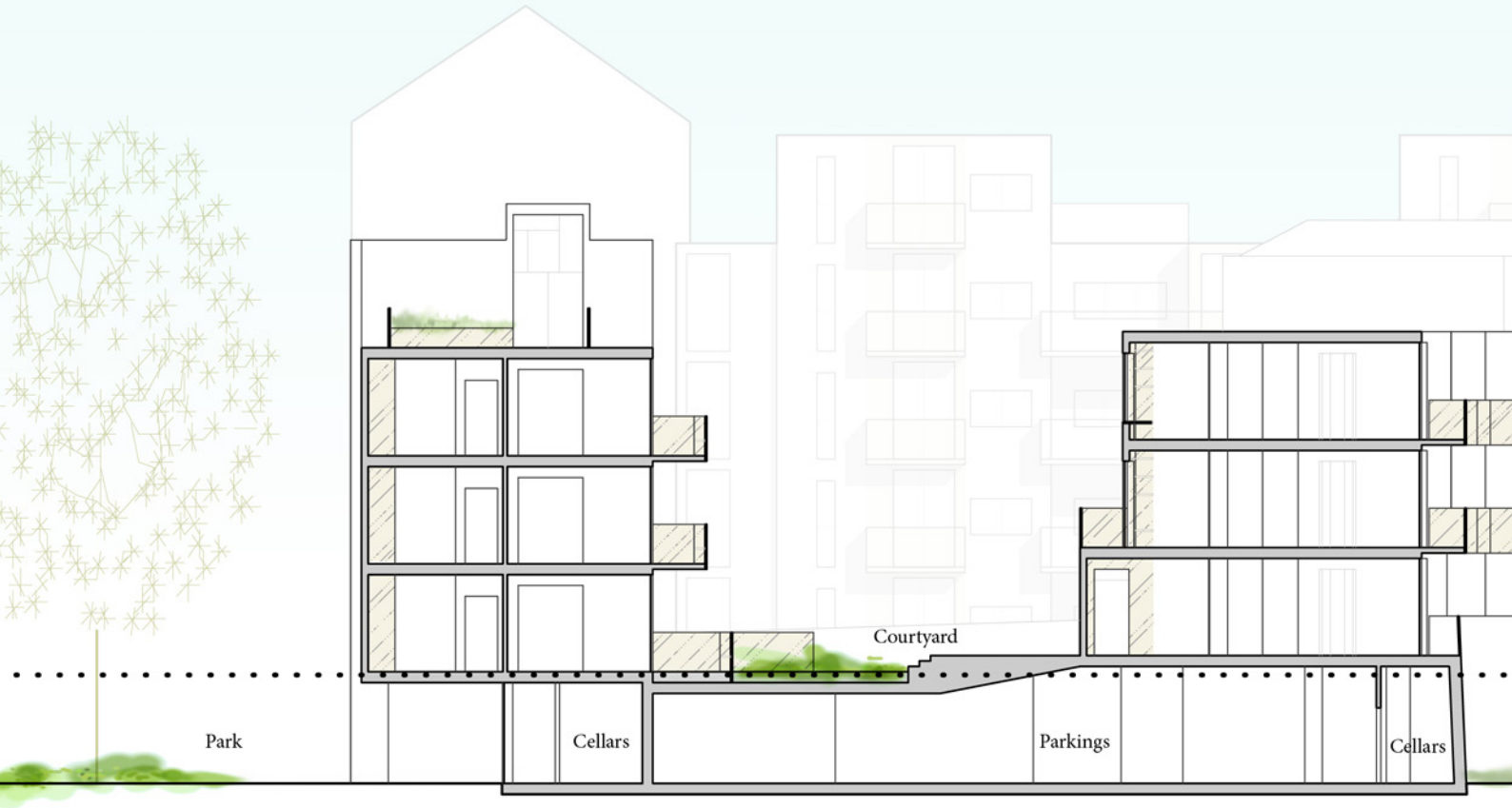
Alteration 8

Variability: unchanged
Outdoor spaces: increased
Dimensions of the indoor spaces: unchanged

From the first floor plan and the images extracted in the present pages is possible to see that the template apartment previously described underwent changes in order to take advantage of the position on the site and create different apartment experiences.
Moreover the composition of these different units created an interesting game of volumes and planes that moved the facades and draw the character of the different paths on the site: courtyard promenade, pedestrian path crossing the buildings, and street front.
In the following pages the reader will be guided in the understanding of the sensuousness of the space through the presentation of sections, elevations, and perspective drawings of the building complex and apartments interiors.

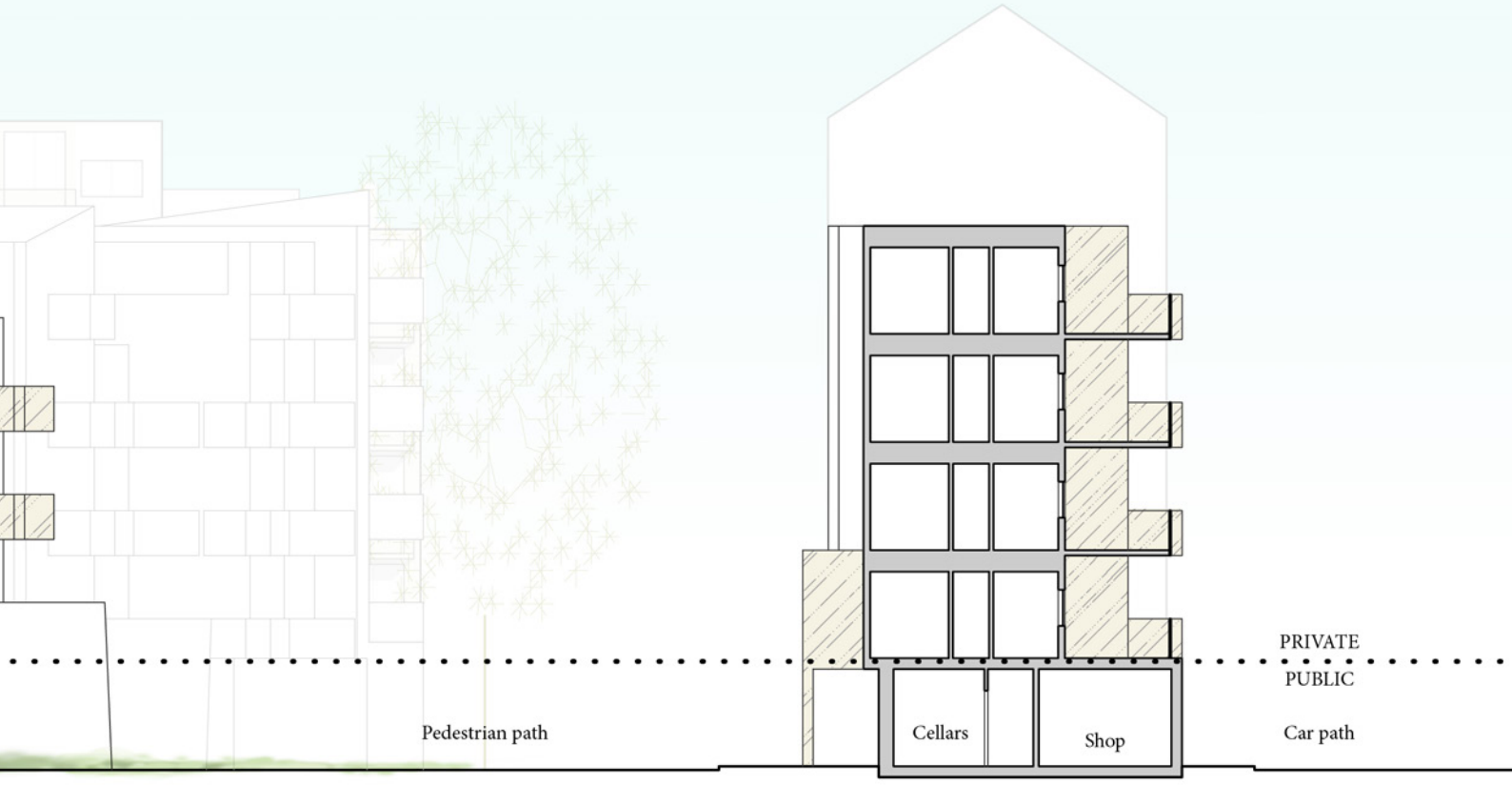


Building section AA' - scale 1:200



Building section BB' - scale 1:200

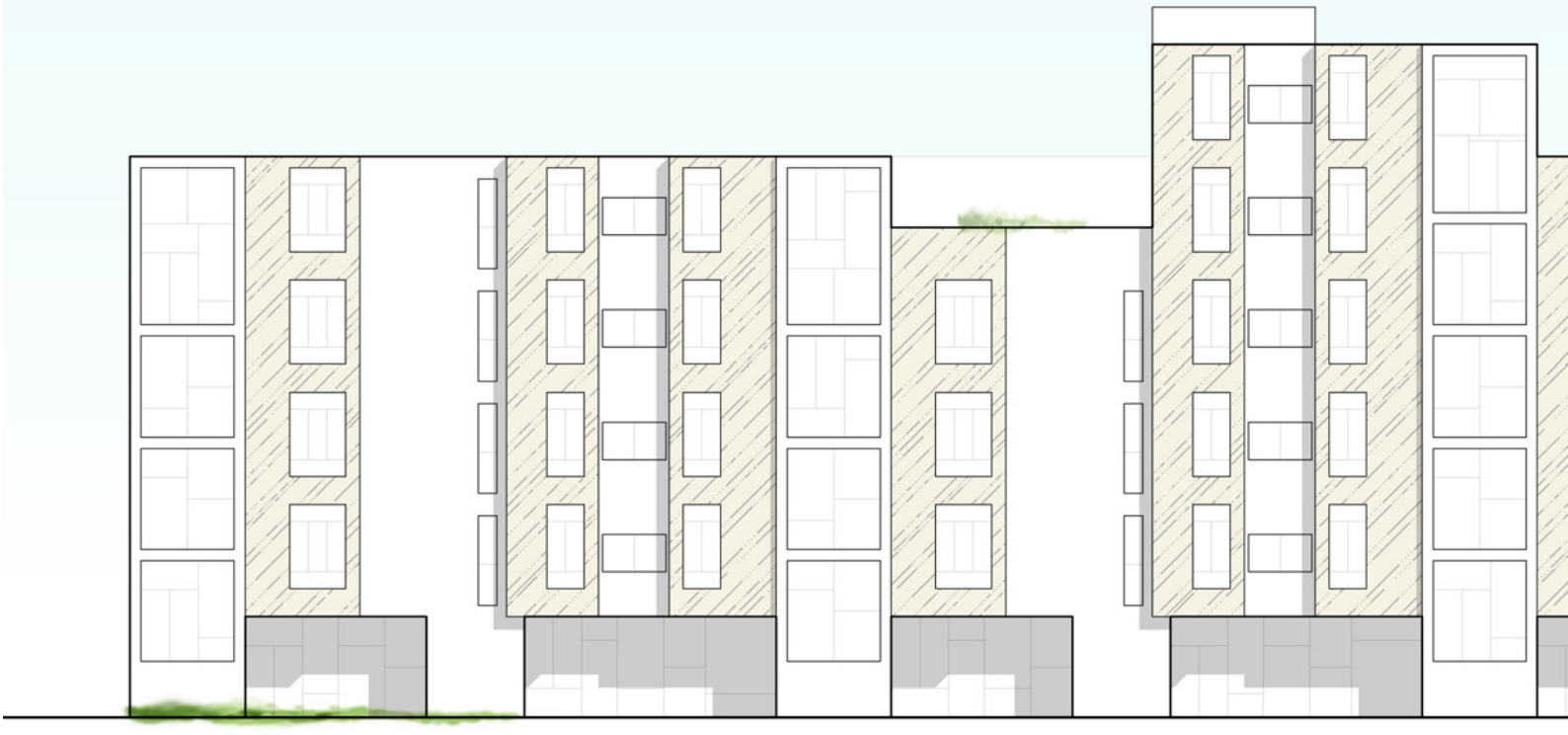

Common storage
Cellars
Pedestrian path
Shop
PRIVATE
PUBLIC
Car path


Pedestrian path
Cellars
Shop
PRIVATE
PUBLIC
Car path

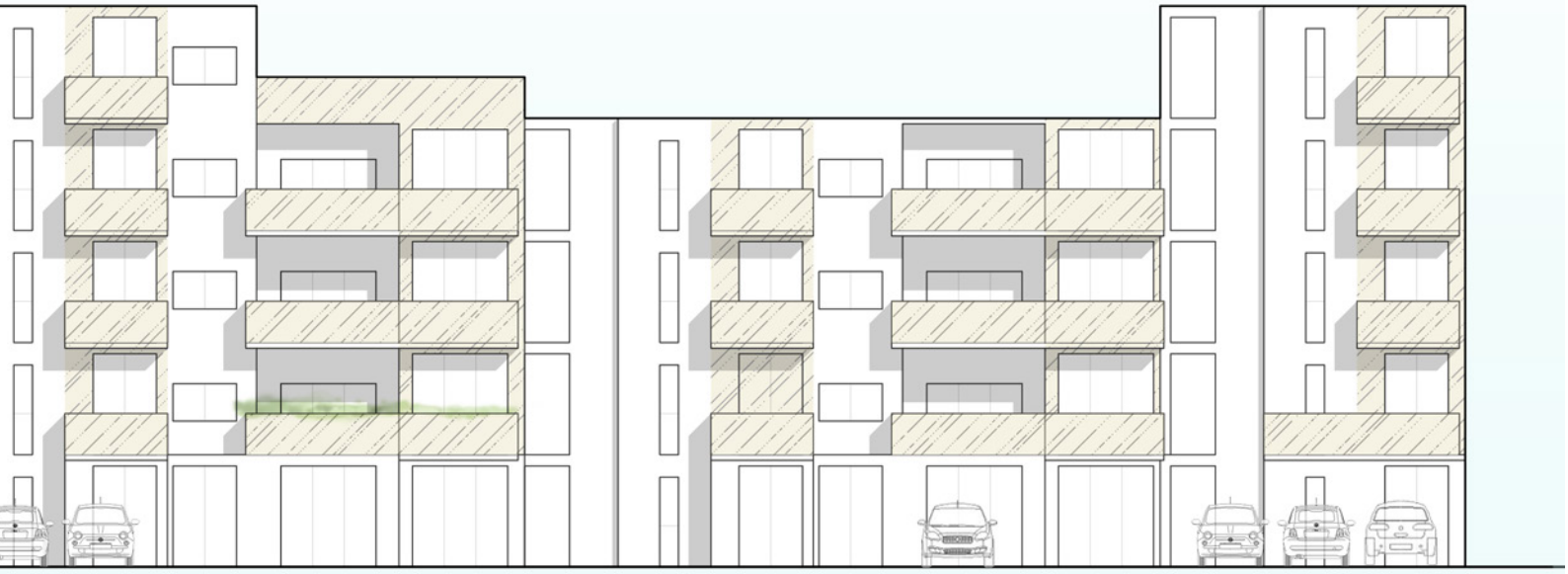
The rigidity of the street front

Building South elevation - street front - scale 1:200

The interaction with the park

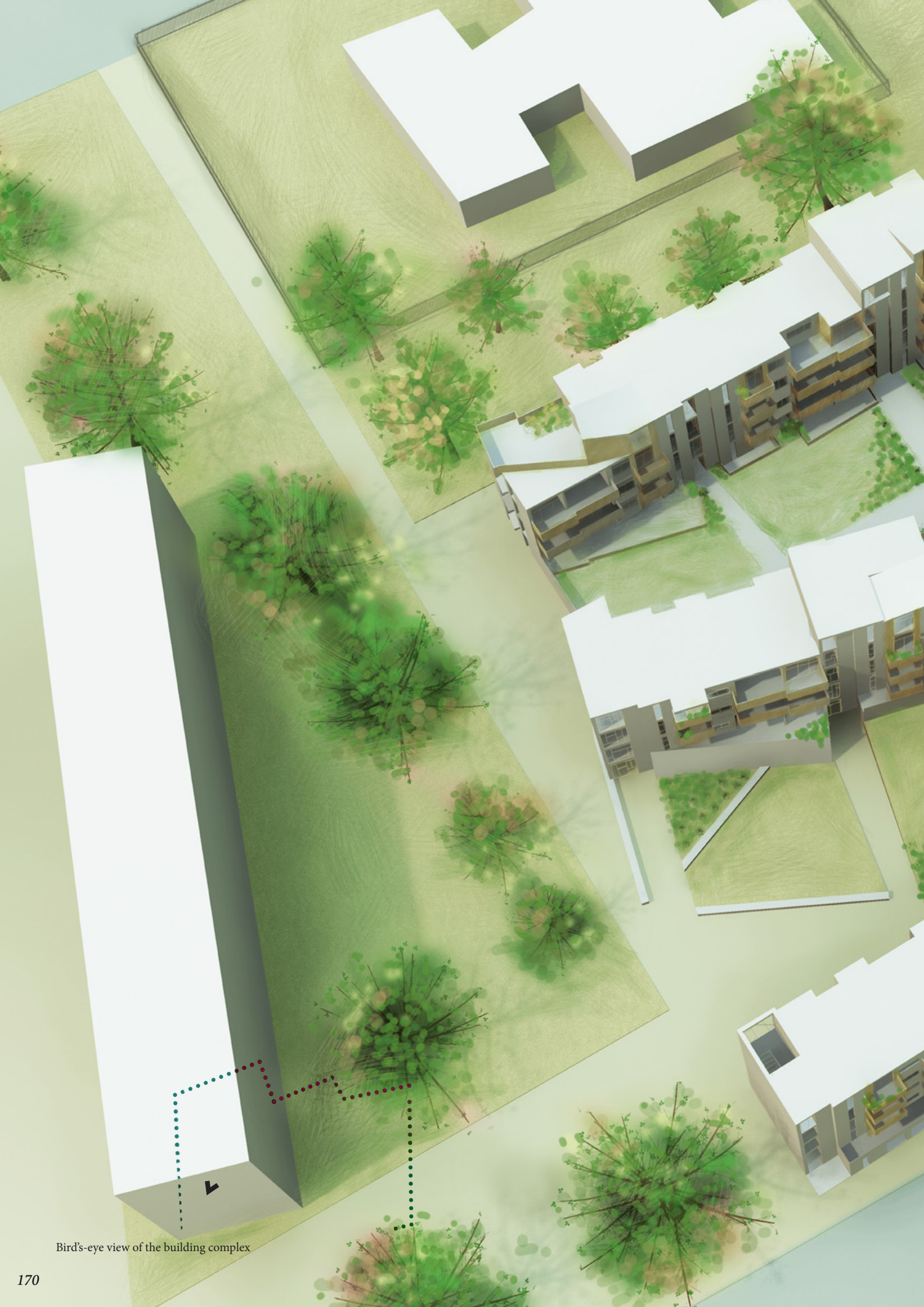


Building North elevation - park front - scale 1:200

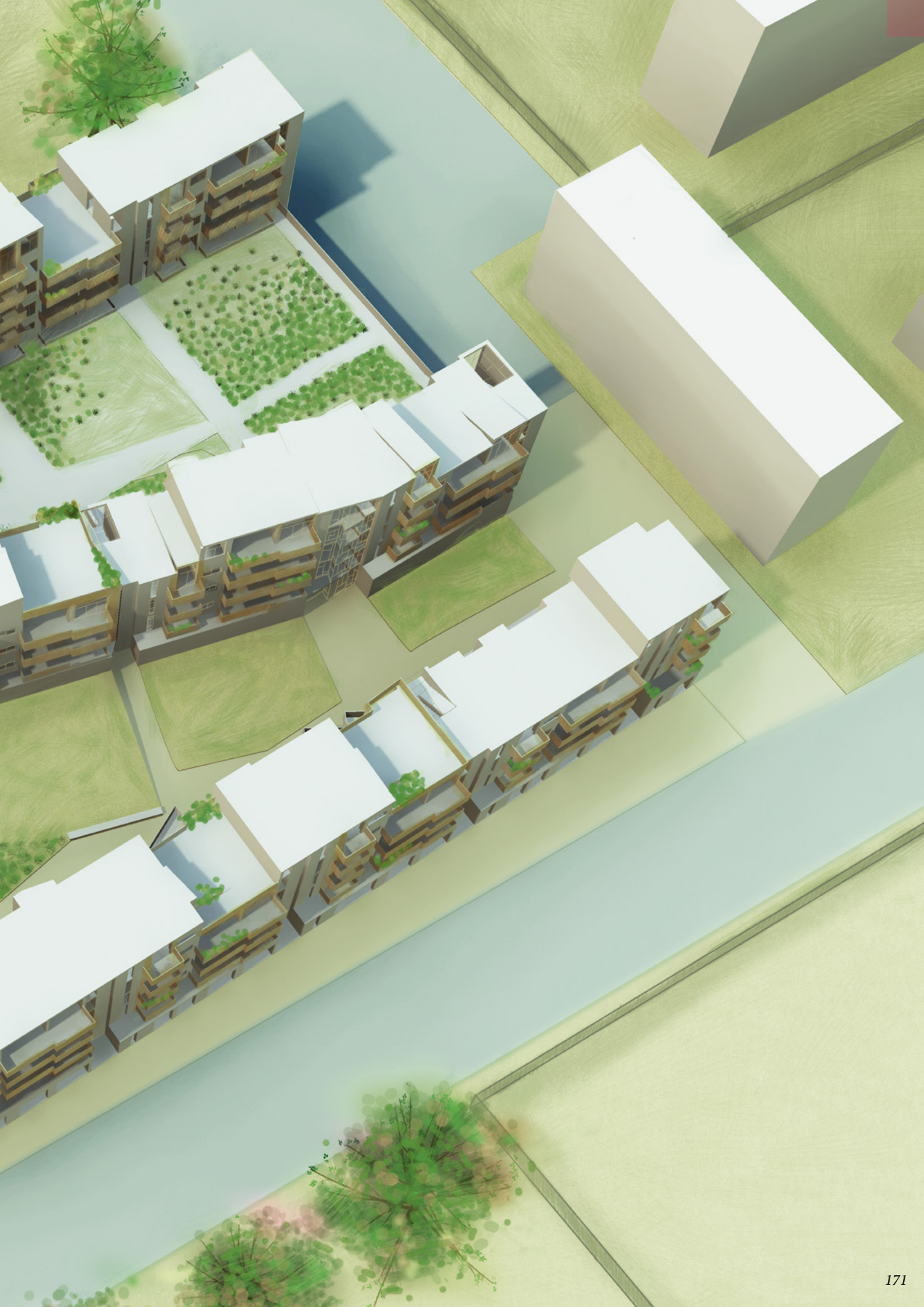


Commercial activities and public services

Covered private promenade. Access to the apartment units from the Western park



Bird's-eye view of the building complex

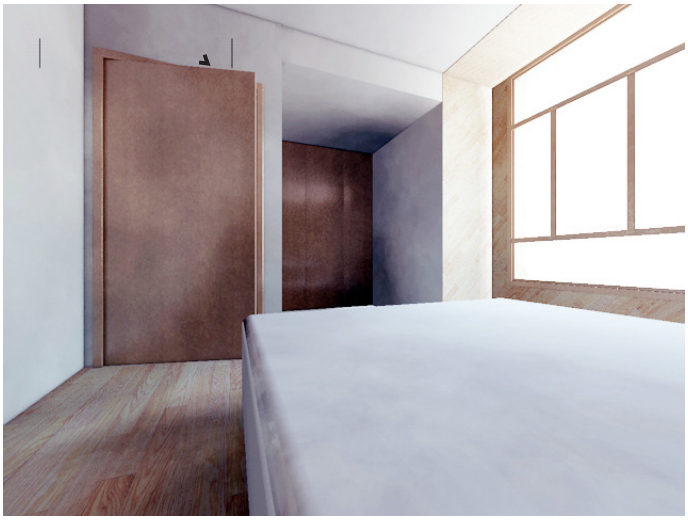


Atmosphere of the pedestrian path in the late afternoon

Atmosphere of the courtyard in a rainy day

View from the living room toward the studio area in three different configurations

Visualization of the children bedroom in three different configurations



Visualizations of the main distribution path (top), master bedroom (bottom left), and of the dining area (bottom right).

GENERAL CONCLUSION

After presenting in the previous pages my personal interpretation of contemporary dwelling in cities and describing the project for a new dwelling complex in Ronchetto S/N is perhaps important to recapitulate the obtained outcomes recalling where I started from.
The present research is the result of a personal interest upon the theme of dwelling developed in the last years of studies and my own life experiences. As described in the preface of this essay indeed changing 'home' from Milan to Aalborg showed me a different dimension of living that made me ask whereas it is possible to improve the city-experience starting from the apartment: flats seem indeed to be the smallest unit of urban space in which a person can find his place-identity. It was my claim that **an apartment in the city can become Home**, fighting against extreme homologation, impersonal rooms, and reduction of space below the comfort-limit. Therefore my primary question was: **how to feel home in a city?**

Which immediately translated in: **how to design an apartment as a frame in which everyone (or each of us) can define his home?**

This question was at the base of a theoretical research focused on the theme of dwelling that revisited the meaning of tectonic architecture in a contemporary way.
Reformulating the Vitruvian triad of *Venustas*, *Firmitas*, and *Utilitas* as **Sensuousness, Functionality, and Permanence** the present essay aimed at anchoring the dwelling design practice to the research of users' sense involvement, study of architectural detail in order to remove wastes but ensuring the minimum space of comfort, understanding of the importance of the relationship between present habits, traditions, and future changes, therefore **clarifying the relevance of body, uses, and time in architecture**.
The review of the triad has been based on and reinforced by the study of several critics and architects, which guided me in the understanding of which are the formal aspects of the architecture that influence the perception of home by users. More specifically they guided me in the understanding of **what makes the indoor space comfortable, how to entrench buildings in the realm, and what makes the identification place-identity last longer**.

The collection of theoretical indications and the analysis of three case studies brought me to the conclusion that a tectonic dwelling result is obtained through the control of the following parameters:

- **Dimensions**, which regilate plan extension and elevation of the locales in order to allow a certain use of the space and arouse specific feelings;
- **Materiality**, which influences colours, texture, lightness, and sound reverberation of the locales and can create specific atmospheres;
- **Disposition**, which controls the sequence of locales (in plan and elevation) that visitors cross in order to emphasize or miti-

gate certain spatial characteristics and influence visitors' perception;
- **Multi-functionality**, which allows to conduct different kinds of activities in the same space, meaning that the locale is not or slightly specialized in order to allow a certain functional flexibility;
- **Variability**, which grants the possibility to modify in time the internal layout configuration in order to suit different purposes and accommodate changes;
- **Extendibility**, which indicates the possibility of the space to extend its dimensions toward outside in order to adapt to changes and grasp environment potentials;
- **Form**, which controls shape and orientation of the building in order to underline a certain attitude to the existing environment and potentially encourage people use and discovering of the realm;
- **Distribution**, which designs internal and external paths of the architecture in order to suit the realm and emphasise the sensuousness of the space;
- **Outdoor organization**, which completes the formal study of the architecture by a specific focus on the outdoor spaces and on the relationship between indoor spaces and outdoor ones.

Moreover, it has been shown that it is not possible to investigate one of these parameters without indirectly involving all the others.

The definition of the project for Ronchetto S/N allowed to verify the relevance of the developed theory in the architectural practice. As stated before the choice of the project area belongs from both the personal interest in the city of Milan, and the will of the Municipality to develop a new dwelling complex in Ronchetto S/N. Pursuant to the Expo 2015 that stimulated and reactivated an architectural debate in the city, the same Municipality asks for a project which promotes a new concept of urban life-style.

After analysing the specificity of the site area, my personal proposal for the development of the site applied the strategy developed through the theoretical research defining a **new urban area which integrates natural and artificial landscape and is suited for families up to four members**.
The emergence of the feeling of place-identity in inhabitants is stimulated by the creation of **differentiated flats that are in constant relationship with the outdoor environment thanks to a system of terraces, gardens, and views.** Moreover, **they accommodate changes in the family structure thanks to a system of movable partitions and the space is detailed in its shape and materiality in order to procure a synaesthetic involvement of the human body**. The dwelling experience is created through a game of compression and extension of the space, emphasized by changes in lightness of the different areas. Change on flooring and wall cladding further underline the vocation of each locale creating in the bedrooms cosy corners and nooks. Multi-functionality, variability and extendibility (or reduction) of the space allow inhabitants to define their personal home-space in the way they consider more appropriate. Bringing this concept further, the distribution on the territory of apartment units with different characteristics according to their position on the site already allows to choose for specific characters of the space: more space in the bedroom, a larger terrace, a smaller dining area, and others can be selected.
Finally, each apartment is designed to have **high energetic performances**, and is conceived as **part of a larger urban project that balance common gathering and private activities promoting a sustainable life-style** from both the energetic and social point of view.
Social interaction is stimulated through the provision of a common courtyard, but also thanks to the presence of common rooms at the ground floor and shops in the street-front building. Also the creation of a pedestrian public path crossing the complex is a useful strategy in this direction. The movement and permeability of the volumes facing all pedestrian paths and the green provision lure visitors and make people crossing the site, potentially continuing the journey until Villa Beltrani, historical site just outside the project area. These characteristics of the complex will stimulate an involvement of inhabitants in the territory and consequently will stimulate their 'appropriation' of the space: the creation of what we called space-identity.

All this considered, is my personal opinion that if the proposed project once again underlined the difficulty (or impossibility) to define a universal and synthetic architectural strategy oriented to tectonic, it successfully designed a frame in which each could define his-own home.
Thus the present thesis showed that creating a different kind of apartments and dwelling experience in the city is possible. It is possible to create urban buildings that put in relation natural and artificial environment and stimulate a waster use of the outdoor spaces. As a consequence it is possible to **encourage people to buy apartments and stay in the city without asking them to renounce lower-density environments qualities**.

In other words, the present report does not constitute a manual for future architects wanting to design dwellings in cities, but **illustrates my personal understanding of tectonic architecture and demonstrates the possibility for architects to opt for a different approach to urban problems of densification oriented toward the creation of Homes**.

APPENDIX 1

STUDIES ON COLOURS

In order to understand the relevance of colours in space, this appendix investigates the sensuousness that belongs from their characteristics (light, dark, bright colours) and from their position in the space (sides, front, top, bottom, more surfaces) taking the studies made by Meerwein (2007) as a reference.

The next diagrams will show how a light and 'calm' colour (a, light blue), compared to a very dark colour (b, brown) and a very saturated and bright one (c, yellow) gives different emotions to users even if it colours the same surfaces. Just in the same way, the relaxing green (d), dark red (e) and light brown (f) chosen by Loos in his Müller House and applied to the surfaces through cladding of different materials influence our perception of the space sensuousness.
The diagrams will compare first spaces with only one coloured surface, then spaces with two coloured surfaces and finally volumes that combine in different ways three and more coloured surfaces.

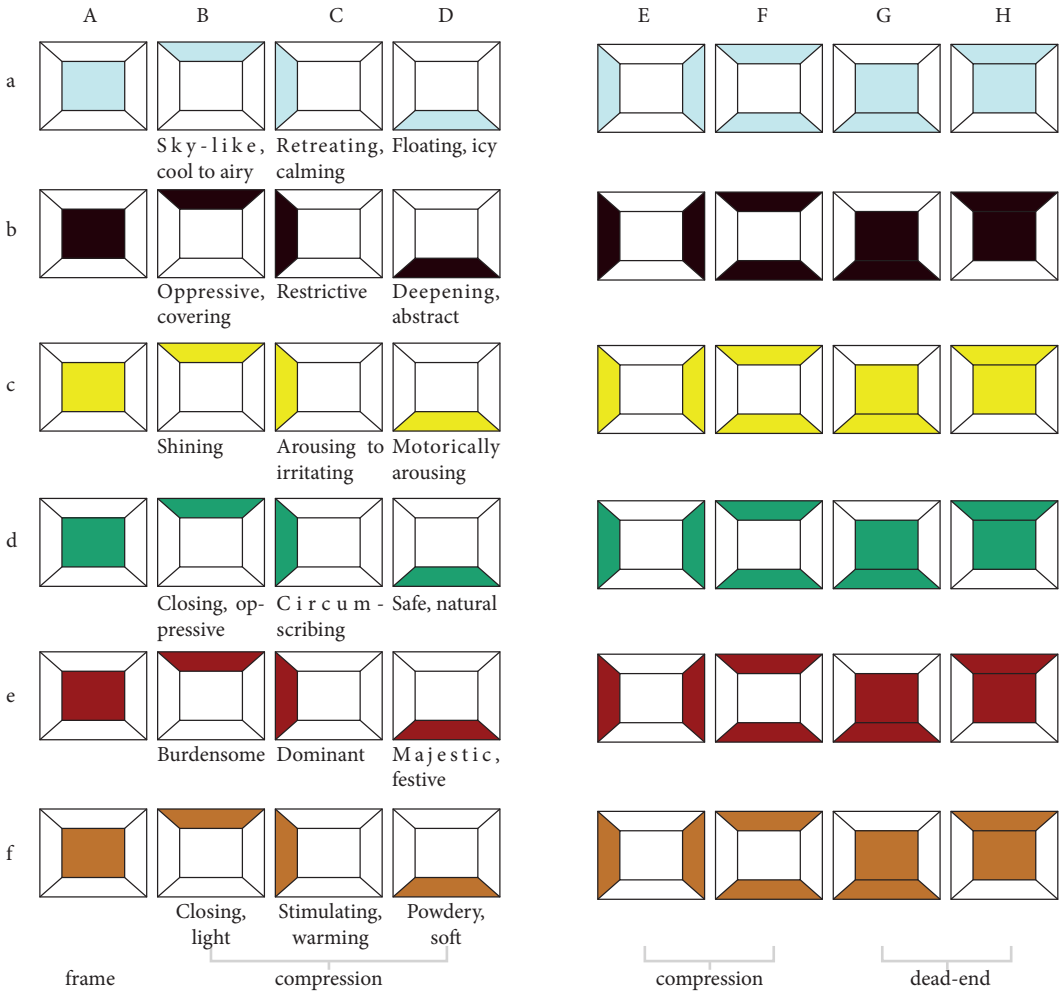


Diagram of colours relevance 1

Watching the diagram above it is possible to notice how position of coloured surface is as relevant as the choice of the colour in itself (Meerwein et al. 2007). As an example, we can say that colour a gives the same feelings of colour b according to the distribution of the coloured surfaces, but colour b emphasizes more those feelings because catches more attention and especially compression is stronger. Differently, colour c catches the users attention as much as dark colours, but without compressing it as much as them.
It is also possible to notice how, comparing columns B, C, D, E and F, the space feels pressed by the coloured surfaces, but in different ways. Column B shows examples of flattened spaces, while spaces

in column C presses visitors on the right side, and the ones in column E force them in the centre and guide them forward. The volumes in column D don't really guide users in a special understanding of the space, but column F shows that colouring only upper surface and flooring you feel the space shorter and larger.
Moreover, columns G and H, combinations of the framed space presented in column A and respectively flooring and ceiling coloured surfaces, show how the view guided forward by bottom or top colour is cheated by ending in a full-coloured surface that catch the attention to a 'dead-end'.

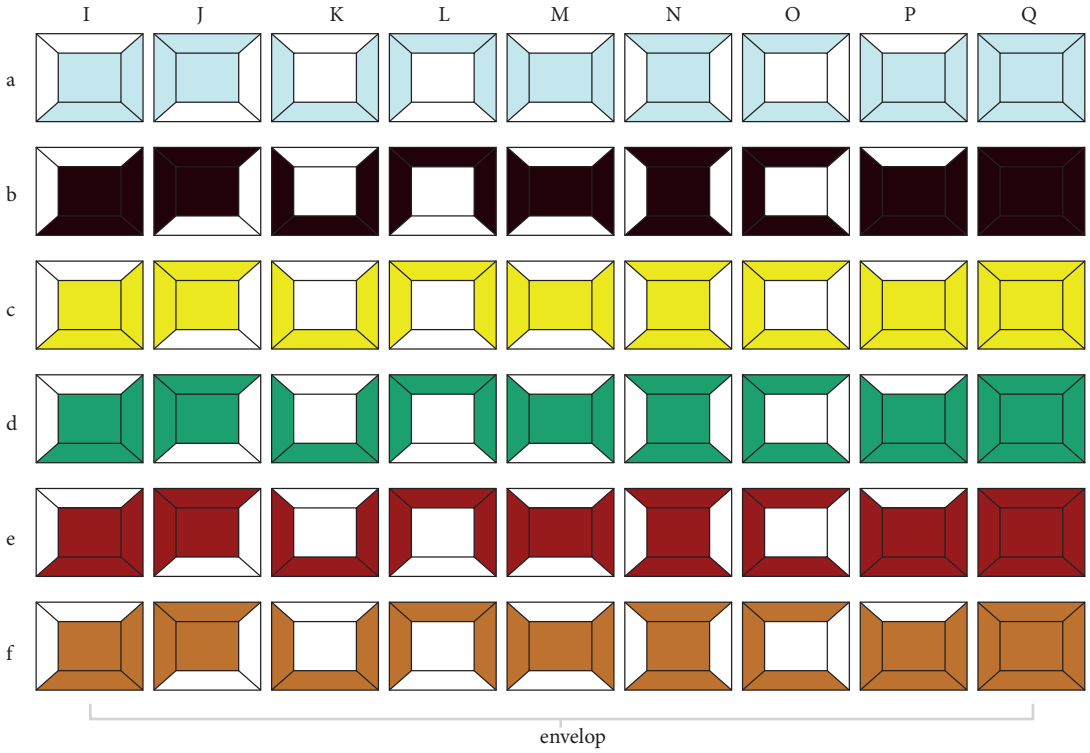


Diagram of colours relevance 2

Further considerations can be done watching diagrams that combine more than two coloured surfaces while forming the space.

If the main feeling belonging from the colouring of on or two surfaces in the spatial composition is compression, painting three or more surfaces visitors have the impression of being enveloped by the space. Similarly to what has been noticed before, by the way each composition can give a slight different feeling of comfort and cosiness (I, K, L, M, N, O, P, Q), compression (J, L, N, O, P, Q), expansion (K, N, O, P), or guidance (I, L, N, O).

Finally, the last diagram shows how combinations of different colours can emphasize or mitigate those feeling of compression and expansion of the space described above. The diagram schematizes the Müller House living locales, further described in all their spatial components from page 45 of this research.

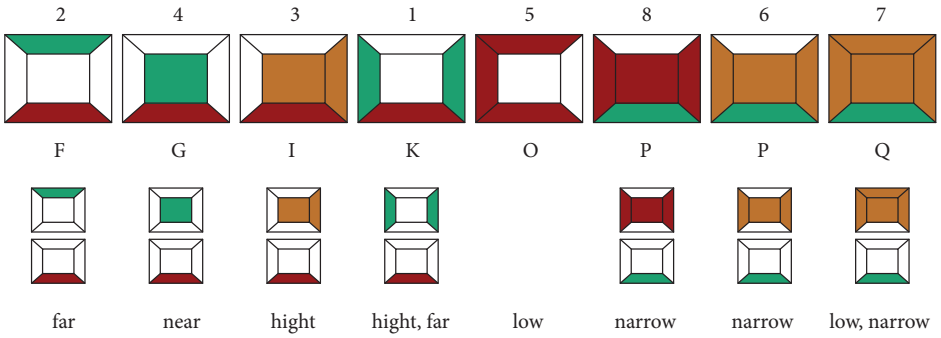


Diagram of colours combination in Müller House. The order of the locales follows the colours schemes above and present the spaces from the less to the most colourful. The little diagrams in the second and third row show how the volumes are coloured combining more simple painting strategies. Letters assigned to each volume relate to the column number of the generic space analysed before whom they refer. Numbers identify: 1-Entrance; 2-Warm room; 3-Cloackroom; 4-Living room; 5-Dining room; 6-Lounge; 7-Boudoir; 8-Library.

APPENDIX 2

REVERBERATION TIME OF MÜLLER HOUSE ROOMS

The sound reverberation calculation of Müller House's living locales has been done using a spreadsheet that applies Sabine's equation:

$$T_{RT60} = \frac{0{,}161 \times V}{\sum Sa} \quad (1)$$

Where:
T_{RT60} = Reverberation time at a given frequency [s];
RT60 = Time required, in seconds, for the average sound in the room to degrease by 60db after a source stops generating sound;
V = Volume of the room [m^3];
$\Sigma Sa = S_1a_1+S_2a_2+...+S_na_n$ = Total absorption of the room at a given frequency, with S = Surface area of the room per material [m^2] and a = Absorption coefficient of the room surface per material at a given frequency.

Moreover, the eq.1 has been implemented to consider the absorption from people, calculated as nA, where:
n = Number of people;
A = Absorption coefficient per person at a given frequency.

Obtaining:

$$T_{RT60} = \frac{0{,}161 \times V}{\sum Sa + nA} \quad (2)$$

All calculations have been done considering a sound frequency of 500Hz.
The table below collects the absorption coefficients of the materials applied to the surfaces in exam at 500Hz.

Table of the materials absorption coefficient a at a sound frequency of 500Hz.

Material	**a (at 500 Hz)**
Carpet	0,06
Wood parquet on concrete	0,07
Marble or glazed tile	0,01
Seats (fabric-upholstered, fully occupied)	0,88
Glass (1/4" plate, large pane)	0,04
Plasterboard (12mm (1/2") panelling on studs)	0,06
Plywood (19mm(3/4") panelling, airspace, light bracing)	0,15
People-adults (per 1/10 person)	0,42
AIR ABSORPTION (m^3 at 20°C and 30%RH)	-

The process of the calculation is shown below through the example of the library space, which has the following characteristics:

Length 3,5 m
Depth 4,17 m
Height 2,55 m
Volume 37,21 m^3

Table of calculation of the equivalent absorption area in Müller House library.

Material	Room detail	Length [m]	Depth [m]	Height [m]	Number of elements	Surface [m2]	Sa at 500Hz [sabin]
Glass	Window	2		1,65	1	**3,3**	**0,13**
Wood	Wall 1	3,5		2,55	1	8,925	
	Wall 2,4	2,08		2,55	2	10,608	
	Tot					**19,533**	**2,93**
Plasterboard	Wall 3	2,09		2,55	2	7,359	
	Wall 5	3,5		2,55	1	8,925	
	Ceiling	3,5	4,17		1	14,595	
	Tot					**30,879**	**1,85**
Carpet	Floor	3,5	4,17		1	**14,595**	**0,88**
Seating	Sofa	2,08	0,9		1	**1,872**	**1,65**

Considering the presence of 2 people in the room, nA at 500 Hz would be 0,84 sabin.
Applying the (2) we therefore obtain:

$$T_{RT60\ Library} = 0{,}72\ s$$

A similar procedure has been use for the other living spaces of Müller House, obtaining:

$$T_{RT60\ Living\ room} = 1{,}96\ s$$
$$T_{RT60\ Dining\ room} = 0{,}89\ s$$
$$T_{RT60\ Lounge} = 0{,}49\ s$$
$$T_{RT60\ Boudoir} = 0{,}38\ s$$

A simple experiment can be done in order to understand the relevance of materials choises in the spatial design that looks for a particular sound atmosphere. The library locale of Müller House is here taken to do some transformations in the cladding materials, before imagining to use reflective materials and later imagining to clad the space with very absorptive ones.

Case 1: Wooden cladding is substituted by Plaster

Table of calculation of reverberation time in Müller House library changing cladding material: increase reflectivity.

Material	Room detail	Length [m]	Depth [m]	Height [m]	Number of elements	Surface [m2]	Sa at 500Hz [sabin]
Glass	Window	2		1,65	1	**3,3**	**0,13**
Plaster	Wall 1	3,5		2,55	1	8,925	
	Wall 2,4	2,08		2,55	2	10,608	
	Tot					**19,533**	**0,39**
Plasterboard	Wall 3	2,09		2,55	2	7,359	
	Wall 5	3,5		2,55	1	8,925	
	Ceiling	3,5	4,17		1	14,595	
	Tot					**30,879**	**1,85**
Carpet	Floor	3,5	4,17		1	**14,595**	**0,88**
Seating	Sofa	2,08	0,9		1	**1,872**	**1,65**

Applying the (2) in this case we obtain:

$$T_{RT60\ Library}{}^{1} = 1{,}04\ s$$

Case 2: Wooden cladding is substituted by drapery

Table of calculation of reverberation time in Müller House library changing cladding material: increase Absorbance.

Material	Room detail	Length [m]	Depth [m]	Height [m]	Number of elements	Surface [m2]	Sa at 500Hz [sabin]
Glass	Window	2		1,65	1	**3,3**	**0,13**
Drapery	Wall 1	3,5		2,55	1	8,925	
	Wall 2,4	2,08		2,55	2	10,608	
	Tot					**19,533**	**10,30**
Plasterboard	Wall 3	2,09		2,55	2	7,359	

Material	Room detail	Length [m]	Depth [m]	Height [m]	Number of elements	Surface [m2]	Sa at 500Hz [sabin]
	Wall 5	3,5		2,55	1	8,925	
	Ceiling	3,5	4,17		1	14,595	
	Tot					**30,879**	**1,85**
Carpet	Floor	3,5	4,17		1	**14,595**	**0,88**
Seating	Sofa	2,08	0,9		1	**1,872**	**1,65**

Applying the (2) in this last case we obtain:

$$T_{RT60\ Library}{}^{2} = 0{,}38\ s$$

Relevant changes in the sound reverberation time can be noticed in both cases.

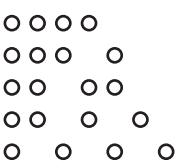
APPENDIX 3

STUDIES ON FLEXIBILITY

In order to understand the relevance of flexibility provision to apartments, this appendix applies the Gibbsian calculation method described by Fawcett (2011) to the example of a family nucleus of 4 members, understanding pro and cons of fixed configurations compared to variable ones.

First of all, we will consider a family of 4 members in which all the members live in the same apartment. In this case, 4 possible grouping layouts present to us:

A
B
C
D
E



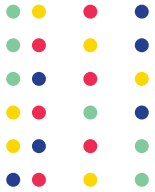
Neglecting members preferences on room characteristics, the possible microstates of each group are:

A

B

C

D



E

For a total of 15 possible microstates.
Imaging now that one member of the family moves out, the group living in the same apartment will be of 3 people, defining three possible groping and a total of 16 microstates here defined:

F

G

H

Considering 2 people living together:

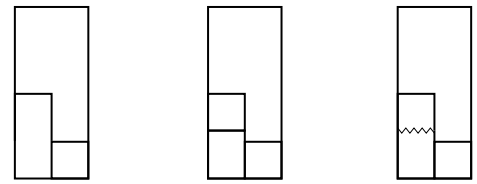
I

J

Finally, if just one member lives in the apartment:

K

The total amount of possible microstates is of 47 configurations.
At this point, it is possible to compare different cases of apartment layout:



Case 1 Case 2 Case 3

Case 1- apartment with 1 triple bedroom and 1 single bedroom: 32 microstates on 47 can be hosted (grouping type B, F, G, I, J, K).
Case 2- apartment with 1 double bedroom and 2 singles: guaranteed 34/47 microstates (grouping type D, G, H, I, J, K).
Case 3- apartment with the possibility to modify the internal layout in order to have 1 triple bedroom+1 single or 1 double bedroom+2 singles: allowed 42/47 microstates (grouping type B, D, F, G, H, I, J, K).

Referring to Holl case study of Fukuoka Housing in particular, we can underline that the architect designs a higher level of flexibility, allowing the transformation of the internal layout until defining from four to 1 bedroom. This strategy allows not only to accommodate 42 microstates of a family

group of 4 members, but also to reduce the space waste, that in the option with fixed rooms is inevitable.

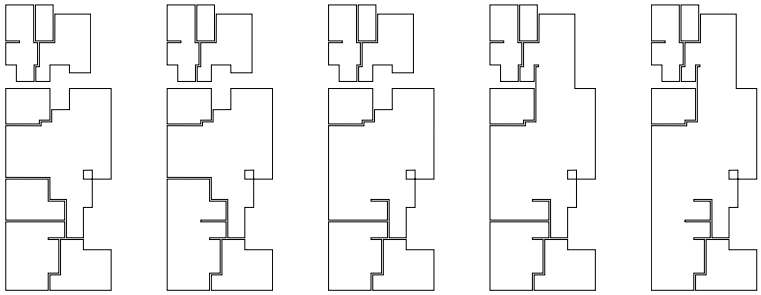


Diagram of the possible indoor configuration in Fukuoka Housing. Example of a I apartment.

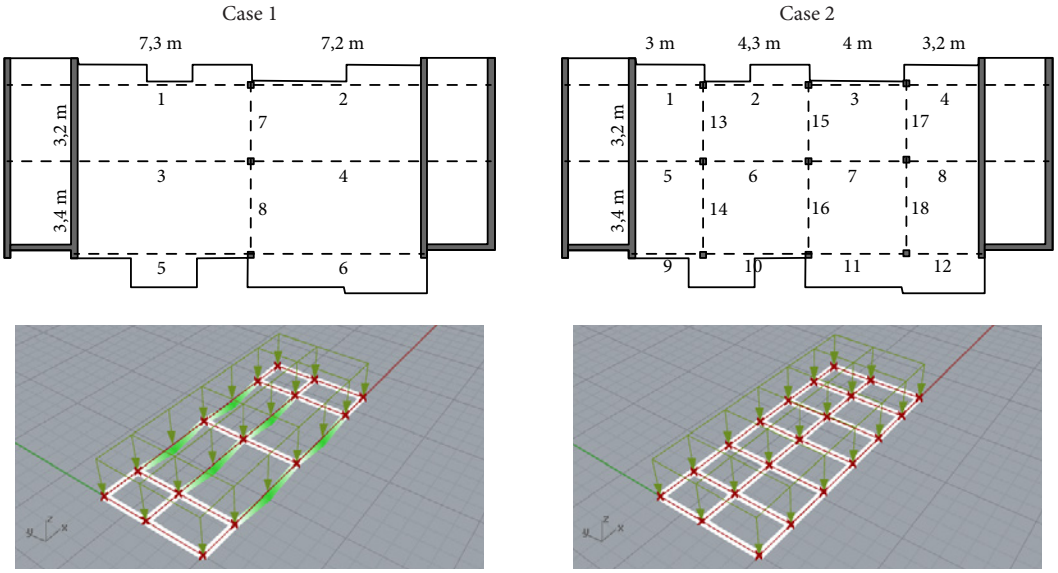
APPENDIX 4

STRUCTURAL STUDIES

The present appendix illustrates the structural studies done on the template apartment designed for Ronchetto S/N in order to define the material and the final dimensions of the structural elements.

The dimensions of the apartment are:
Total length: 14,5 m
Maximum depth: 7,7 m
Overhang balconies: 1,15 m

Considering the staircase as statical element, calculations have been done in order to understand whether was reasonable to divide the total length of the apartment using a single line of columns (case 1 below) or it was necessary to create three lines of columns (case 2 below).



Structural scheme comparison. The pictures show the two analysed options for a structural definition of the designed apartments. In green, the most deflected regions of the beams.

The ceiling layering proposed is here described:

Concrete flooring with floor heating: 100 mm
Sundolitt plates for step sound reduction: 40 mm
Slab of reinforced concrete: 140 mm
Insulation panels: 150 mm
Plasterboard: 18 mm

The permanent load of structural elements is g_1=3,3 kN/m^2
The permanent load for non structural elements is g_2=2,9 kN/m^2
The total permanent load calculated for the ceiling above results to be g_k=6,2 kN/m^2

Using the Eurocode indications for dwelling, it can be assumed a variable load on the structure q_k=2 kN/m^2

Moreover, the combination coefficient ψ=0,7 is indicated as well as the values of partial action coefficients:
γ_{G1}= 1,1
γ_{G2}= 1,5
γ_Q= 1,5

Therefore, when verifying the structure in its Serviceability Limit State (SLS) will be applied the

following combination of loads:

$G_1+G_2+ \psi Q = 7,6$ kN/m^2

While for the Ultimate Limit State (ULS) will be applied:

$\gamma_{G1} G_1+ \gamma_{G2} G_2+ \gamma_Q \psi Q = 10$ kN/m^2

As we can see from the pictures above, the structure 1 is much more stressed than the second one.
In order to understand in which conditions the structure could resist to the SLS load combination, different materials were applied and the maximum displacement u_{eff} of the beams was taken into consideration.
The value of the effective displacement was compared with the allowed one u_{all} in order to verify for which cross section the relation $u_{eff} \leq u_{all}$ is respected.

We define:

$u_{all}= 0,2\%$ L *for concrete structures*
$u_{all}= 0,5\%$ L *for timber structures*
$u_{all}= 0,4\%$ L *for steel structures*

Where L is the length of the beam.

Therefore in the case 1, where the beam has a maximum length of 7,3m, u_{all} would be namely 0,015m with a concrete structure; 0,036m with a timber structure; 0,03m with a steel structure.

Differently in the case 2, where the beam has a maximum length of 4,3m, u_{all} would be namely 0,008m with a concrete structure; 0,02m with a timber structure; 0,017m with a steel structure.

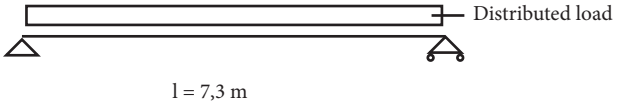
The next table shows the input properties of the chosen materials and the results of the tests done with Karamba in order to verify the relation between allowed displacement and effective one named above in both configurations 1 and 2.

	Concrete (rectangular section)	**Timber C24 (rectangular section)**	**Steel (HE-B section)**
Young modulus (kN/cm^2)	3000	1100	20000
Shear modulus (kN/cm^2)	2100	69	7930
Specific weight (kN/m^3)	24	3,43	80
	Minimum dimensions of the beam cross section (Height X Width)		
Case 1	51X25 cm	77X50 cm	16X15cm
Case 2	44X25 cm	64X50 cm	14X15 cm

The results collected above show that according to the difference in the dimension of the cross section in case 1 and case 2 is relatively small using the same material. Nonetheless it underlines that the choice of a timber structure might not be the best because it would require a too big cross sections. Just in the same way, a concrete beam with a cross section 44X25 cm would exceed the ceiling thickness, creating problems for the designed system of movable partitions (for a focus on movable partitions see pages 156-157).
For this reason a steel structure has been chosen.

Further studies have been done applying the ULS load combination and doing some hand calculations.

Considering the case 1, the beam 3 has been analysed.



Applying the load combination of the ULS it is possible to obtain the maximum bending moment of the beam M_{max} and compare it with the allowed bending moment M_{all} in order to verify that:

$M_{max} < M_{all}$

The ceiling on the right of the beam has a length of 3,4 m; differently the ceiling on the left has an extension of 3,2 m.

Therefore the load on the beam is:
10 kN/m^2*3,3m = 33 kN/m

Calculating the M_{max}:
M_{max}= 33*7,3^2/8 kNm = 219,8 kNm

For steel structures M_{all} is calculated as $M_{all} = W_y\sigma_{yd}$ where W_y is the plastic moment of resistance of the cross section and σ_{yd} is the yield strength of the material.

Thus we have to verify that 219,8 kNm < $W_y\sigma_{yd}$

Solving by W_y and using steel S235-Fe360 with σ_{yd}=160 N/mm^2:

W_y> 219,8*10^6/160 mm^3
W_y> 1373750 mm^3

This value is satisfied by using a steel beam with cross section HE 280 B that has a W_y=1380000 mm^3 (Cannarozzo 2013).

Differently, applying similar calculations to the beam 6 of case 2, which has a span of 4,3m:

M_{max}= 33*4,3^2/8 kNm = 76,2 kNm
And W_y> 476250 mm^3

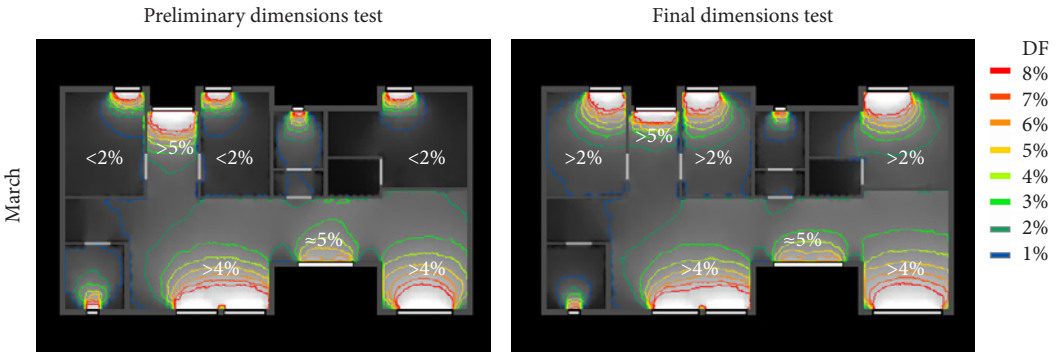
In this case a profile HE 220 A, which has a W_y=515000 mm^3, would be sufficient (Cannarozzo 2013).

All this considered in the project beams HE 280 B in steel S235-Fe360 have been applied.

APPENDIX 5

WINDOWS DEFINITION

The present appendix is devoted to collect the material related to the definition of the facade openings dimensions in the designed template apartment for Ronchetto S/N.
With this aim below it is shown a comparison between an early openings solution and the final one. The drawings are a visualisation of the daylight factor (DF) calculation done by the software Velux, which considers geographical position of the building and date of the calculation, and therefore the position of the sun.



Daylight factor calculation. The renderings show the DF of the template apartment at the level of the working planes (90 cm) at 12 am th 21st March with two different windows solutions (columns). Numbers indicate the average DF stating whether it is above or below the goal value named by Danish standards. The results have been found using Velux Daylight Visualizer2.

The first solution shows a good illumination of the living areas, but a poor natural daylight in the sleeping areas, whereas the second solution improves it significantly.

In the next pages, it is possible to read datas of the windows of the two solutions above.
The first openings have been dimensioned considering the Italian requirements related to airflow change and lighting only (Comune di Milano 2013), applying the relations:

$$A_{g\,open} \geq (1/10)A_r$$
$$A_{g\,light} = (1/3)a + b \geq (1/10)A_r$$
or
$$A_{g\,light} = (1/2)a + b \geq (1/10)A_r \qquad \textit{if the window faces } \pm 60° \textit{South}$$

Where:
$A_{g\,open}$ is the area of the operable part of the window, valid for air flow change;
$A_{g\,light}$ is the area of the glassed part of the window, valid for lightning;
A_r is the area of the room;
a is the glassed area interested by overhang shadowing and is calculated as 1/2 L-d (L is the length of the overhang and d is the distance between the ceiling and the top part of the glass);
b is the surface of the glassed area entirely usable for lightning purposes and is calculated subtracting from the total glass area the surfaces a and c (c = glassed area below 60 cm from the floor level).

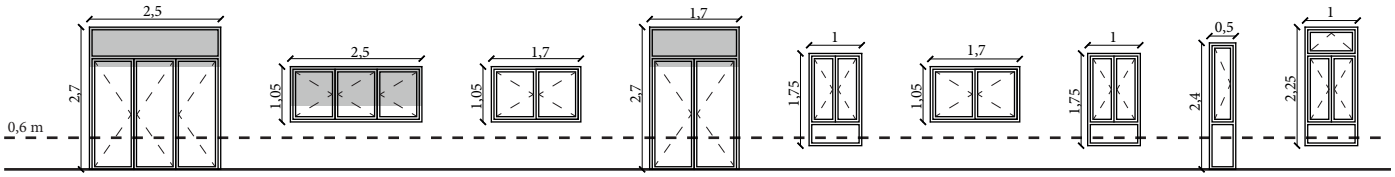
Differently the second solution increased the window areas in the bedrooms in order to reduce dark areas, accepted only in the service spaces. The Italian regulation does not defines standards for Daylight factor in dwellings, therefore the verifications refered to Danish indications.
Namely the goal of the change was to reach the following Daylight Factors:

- Average bedrooms DF≥2%
- Average living areas DF≥4%
- Average working and studying areas DF≥5%

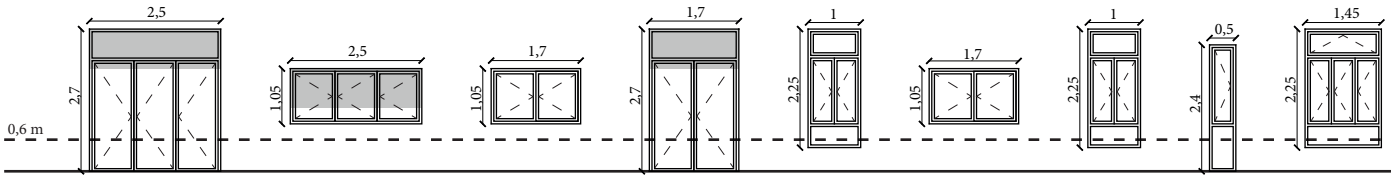
Table of the windows dimensions and verification according to Italian requirements.

Room		Dining room	Kitchen	Living room		Bed-room 1	Studio	Bed-room 2	Bath-room	Bed-room 3
				1	2					
Room area [m²]		11,5	7,5	17,7		10	4,8	8	4	14
Required min glass area [m²]		1,15	0,75	1,77		1	0,48	0,8	0,4	1,4
Overhang [m]		1,45	3	0	1,45	0	0	0	0	0
Exposition		S	S	S	S	N	N	N	N	N
Solution 1	**Glassed area [m²]**	5,36	1,8	1,2	3,58	1,2	1,2	1,2	0,7	1,5
	$A_{g\,light}$ [m²]	3,5	0,9	1,2	2,37	1	1,2	1	0,5	1,4
	$A_{g\,open}$ [m²]	4,17	1,8	1,2	3,78	1	1,2	1	0,4	1,2
Solution 2	**Glassed area [m²]**	5,36	1,8	1,2	3,58	1,5	1,2	1,5	0,7	2,11
	$A_{g\,light}$ [m²]	3,5	0,9	1,2	2,37	1,4	1,2	1,4	0,5	1,9
	$A_{g\,open}$ [m²]	4,17	1,8	1,2	3,78	1	1,2	1	0,4	1,6

Preliminary dimensions



Final dimensions



Dining r. Kitchen Lining r.1 Lining r.2 Bedroom 1 Studio Bedroom 2 Bathroom Bedroom 3

Windows elevations. Comparison between the two analized solutions. On the top: windows used in the preliminary study; on the bottom: windows used in the final study.

WALLS PERFORMANCES

The present appendix collects the information related to walls performances of the proposal for the dwelling complex in Ronchetto S/N.

Transmission Coefficients (U-value) and acoustic performances of the vertical partitions are hence here illustrated. Calculations were indeed necessary in order to define the final layering of the walls respecting the Italian standards described in DL311/2006 and DPCM 5/12/1997, here summarized:

- The U-value of external walls has to be $U_{wall} \leq 0{,}34 W/m^2K$
- The acoustic insulation of external walls has to be $D_{2m,nT,w} \geq 40dB$
- The acoustic insulation of internal partitions between apartment units has to be $R'_w \geq 50dB$

No indications are specified on U-values and acoustic insulation of other internal partitions.

The U-value [W/m^2K], or Transmission Coefficient, is estimated by the formula (DS 418:2011):

$$U = \frac{1}{R_{si} + \sum_{i=1}^{n} \frac{d_i}{\lambda_i} + R_{se}}$$

Where:
R_{si} is the surface resistance at the inner surface, equal to 0,13 m^2K/W
d_i is the thickness for each material layers
λ_i is the thermal conductivity for each material layer
R_{se} is the surface resistance at the outer surface, equal to 0,04 m^2K/W

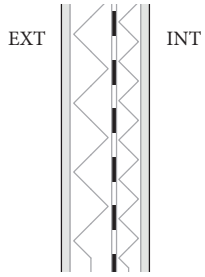
$D_{2m,nT,w}$ and R'_w [dB]of light walls are estimated using the formula (DPCM 5/12/1997):

$$20\log(M'_s) + 10\log(t_i) + t_p + 5$$

Where:
M'_s is the total superficial mass of the wall [kg/m^2]
t_i is the thickness of the space between panels in cm
t_p is the thickness of panels in mineral fibre in cm

Finally, wanting to allow a certain flexibility of the space through the positioning of movable partitions, the weight of the walls has been taken into consideration.
The following diagram shows the characteristics of the applied solutions while in the next page is possible to see the position of each wall type in the plan of the template apartment.

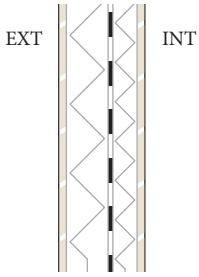
Wall type 1
Plasterboard cladding and polystyrene insulation



18,6 cm

U= 0,26 W/m^2K
$D_{2m,nT,w}$= 47 db
33,9 kg/m^2

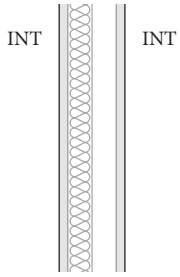
Wall type 2
Wood cladding and polystyrene insulation



18,2 cm

U= 0,24 W/m^2K
$D_{2m,nT,w}$= 46 db
28,7 kg/m^2

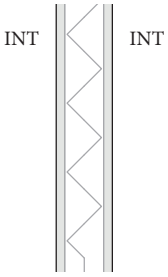
Wall type 3
Plasterboard cladding and glass wool insulation



13,6 cm

U= 0,28 W/m^2K
R'_w= 47 db
33,4 kg/m^2

Wall type 4
Plasterboard cladding and thin polystyrene insulation



11,6 cm

U= 0,26 W/m^2K

29,6 kg/m^2

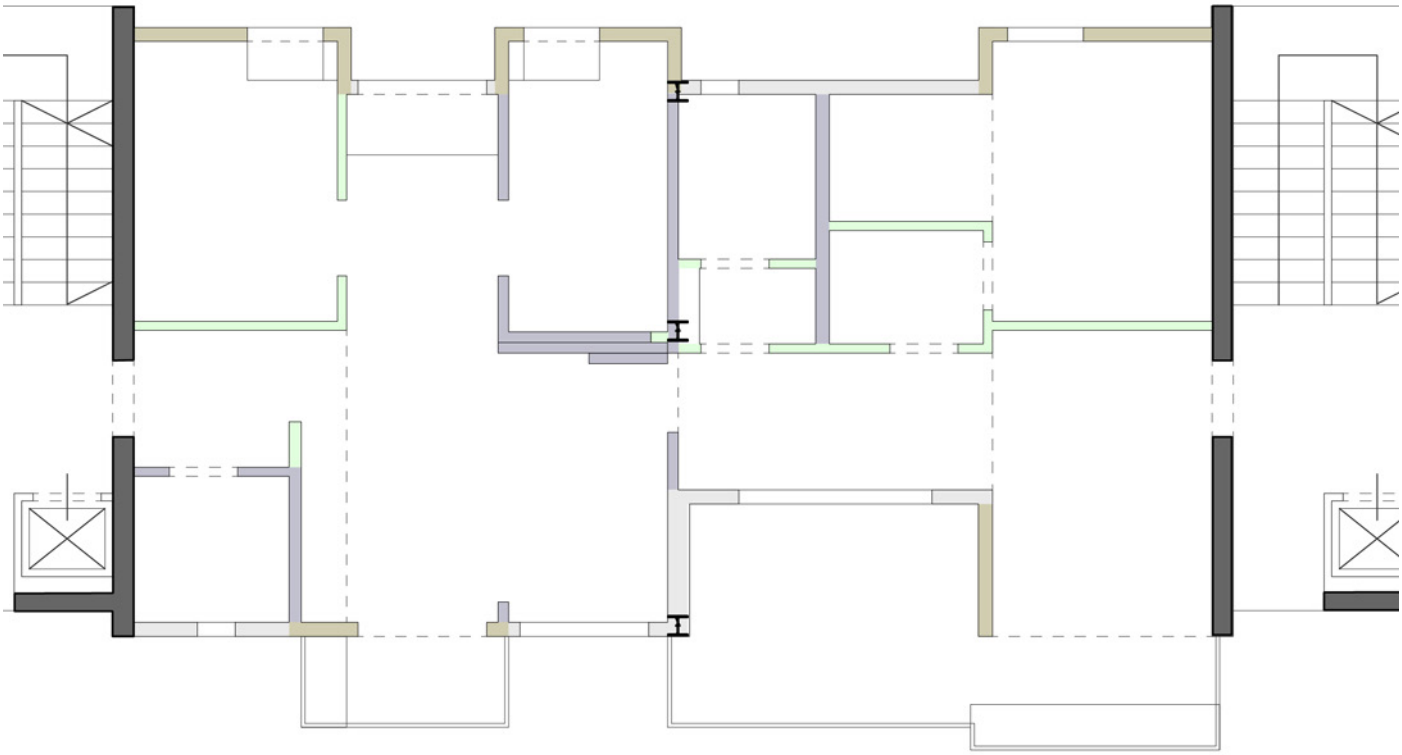


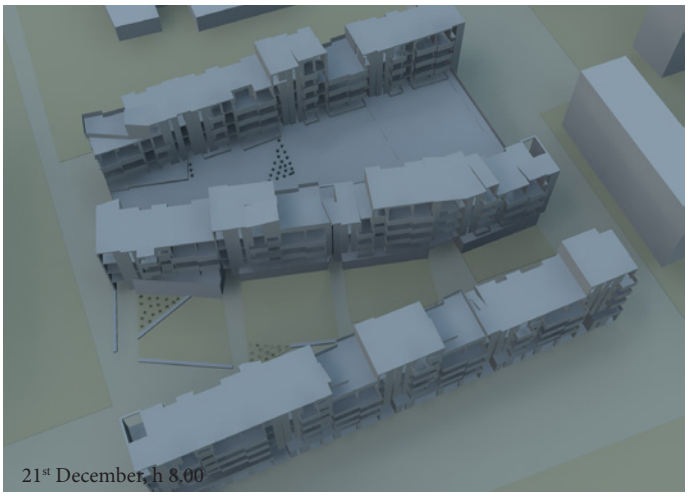
Diagram of wall type distribution. The diagram refers to the template apartment. In black the structural elements.

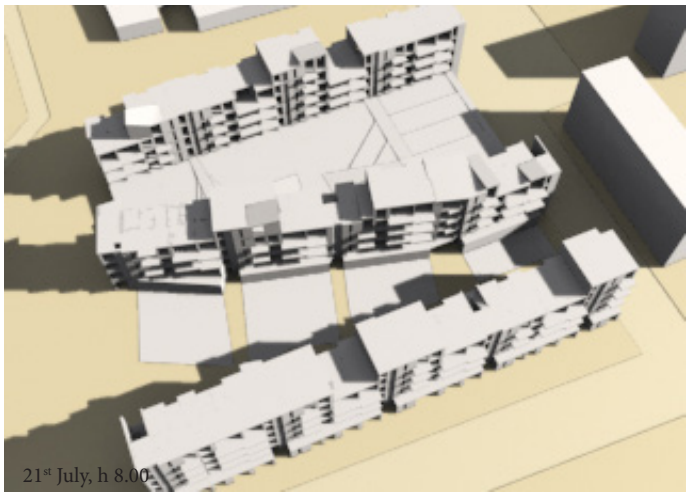
- Type 1 - plasterboard cladding and polystyrene insulation U=0,26 W/m²K
- Type 2 - wood cladding and polystyrene insulation U=0,24 W/m²K
- Type 3 - plasterboard cladding and glass wool insulation U=0,28 W/m²K
- Type 4 - plasterboard cladding and polystyrene insulation U=0,5 W/m²K

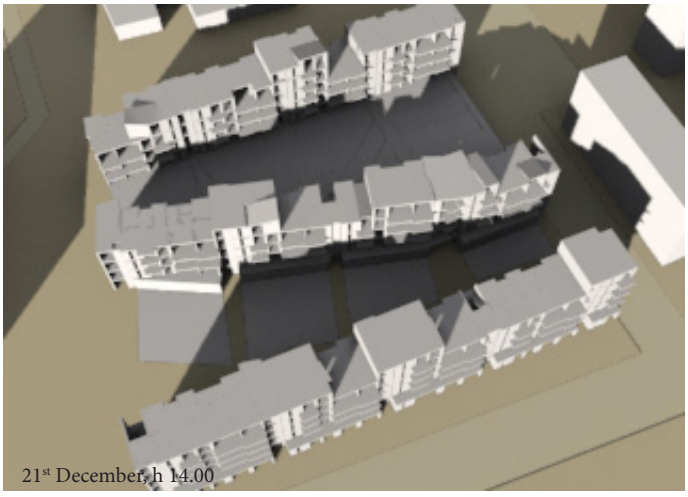
APPENDIX 7

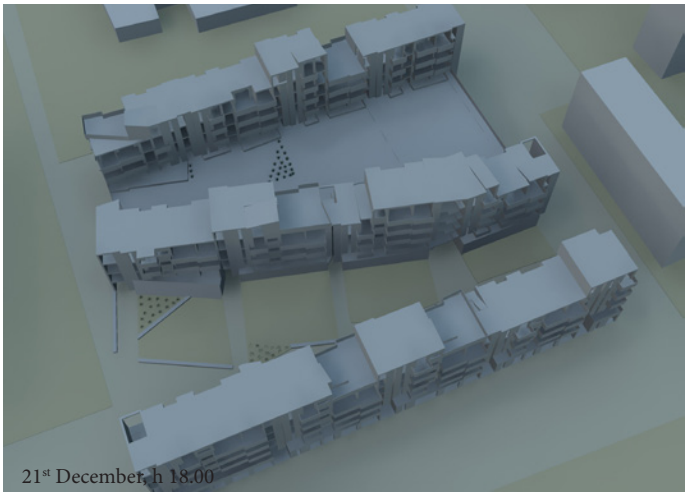
BUILDING PERFORMANCES

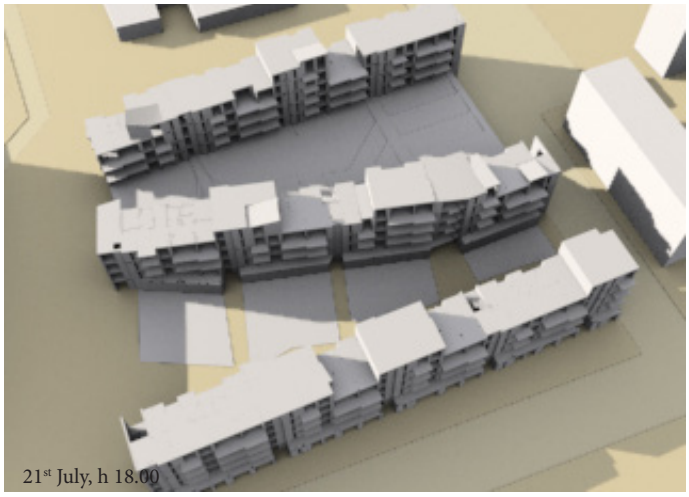
The present appendix is devoted to summarize the studies on building form done for the definition of the final design of the presented project in Ronchetto S/N.
First considerations related to the form of the buildings concerned shading. A comparison between different solutions have been done in order to define the final stacking layout reducing overshadowing (especially at the first floors). Below the visualization of the final design in different moments of the year.







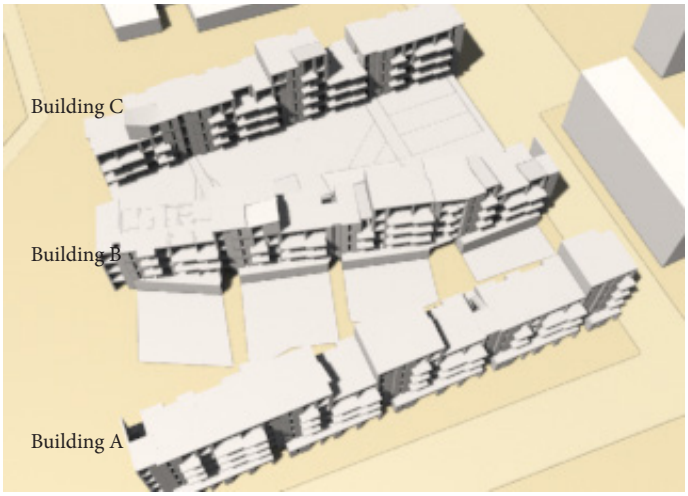




Shadows visualization. The renderings show the shadows on the outdoor spaces of the building complex in different hours of the day (rows) and in different months (columns).

The shadows visualization has been done using the daylight system of Autodesk 3ds Max, which keeps into consideration geographical position of the building and time, therefore calculating the correct position of the sun and shadows projection.

Energetic requirements



Key numbers, kWh/m² year

Energy frame in BR 2010

Without supplement	Supplement for special conditions	Total energy frame
53,1	0,0	53,1
Total energy requirement		28,3

Energy frame low energy buildings 2015

Without supplement	Supplement for special conditions	Total energy frame
30,3	0,0	30,3
Total energy requirement		22,8

Energy frame Buildings 2020

Without supplement	Supplement for special conditions	Total energy frame
20,0	0,0	20,0
Total energy requirement		17,1

Contribution to energy requirement

Heat	27,4
El. for operation of bulding	0,4
Excessive in rooms	0,0

Net requirement

Room heating	22,9
Domestic hot water	13,1
Cooling	0,0

Selected electricity requirements

Lighting	0,0
Heating of rooms	0,0
Heating of DHW	0,0
Heat pump	0,0
Ventilators	0,2
Pumps	0,1
Cooling	0,0
Total el. consumption	36,8

Heat loss from installations

Room heating	4,5
Domestic hot water	0,0

Output from special sources

Solar heat	0,0
Heat pump	0,0
Solar cells	0,0
Wind mills	0,0

Be10 results. The picture shows the results of the calculations done using Be10 related to energy performances of one of the building A.

In order to verify the sustainability of the chosen design solution, calculations of the energy requirements have been done.
Considering that Milan is in the climatic zone named E by the DL 311/2006 and the project consists on a dwelling building with a relation between surface and volume S/V<0,2 the Italian requirements define the maximum energetic consumption of the building at 34 kWh/m^2 year (DL 311/2006).
To have a quick understanding of the project performances, calculations on the proposal have been done using Be10. Even if referring to Danish standards, Be10 considers the same parameters that the Italian regulations ask to investigate, giving a good approximation of the final energetic costs of the architecture in use: the total energy demand is calculated indeed according to EN 14335, that bases a common European methodology.
In this case, the calculations have been limited to the study of the street-front building of the dwelling complex (building A in the picture on the side). The three blocks are indeed similar and similar results can be assumed for all of them.
The analysed block has a ground floor surface of 757 m^2 dedicated to common facilities and shops, while the upper four floors, with a total heated surface of 2110 m^2, are dwellings.
The building has a rotation of 23° ACW and the vertical glazed surfaces are the 29% of the heated floor area.
Balconies, terraces, and movements of the facades constitute the main shading, nonetheless the presence of internal curtains has been assumed at every window (F_c = 0,9).
In calculations a mechanical system for the extraction of exhausted air is defined in bathrooms and kitchens. For all other spaces, natural ventilation is described using standard values.
Finally, the building is assumed to be linked to the district heating system.
As we can see from the picture on the side, the building here defined would have a **total energy requirement of 28,3 kWh/m^2 year**, respecting also Italian requirements for new constructions.

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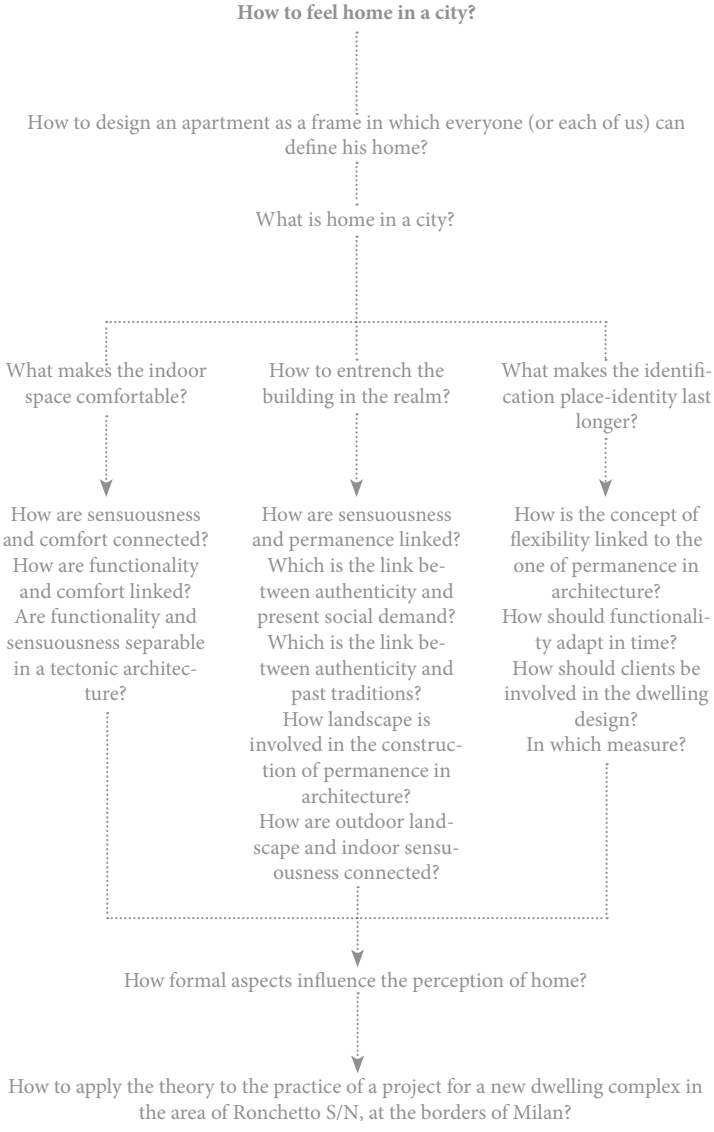

How to feel home in a city?
How to design an apartment as a frame in which everyone (or each of us) can define his home?
What is home in a city?
What makes the indoor space comfortable?
How to entrench the building in the realm?
What makes the identification place-identity last longer?
How are sensuousness and comfort connected?
How are functionality and comfort linked?
Are functionality and sensuousness separable in a tectonic architecture?
How are sensuousness and permanence linked?
Which is the link between authenticity and present social demand?
Which is the link between authenticity and past traditions?
How landscape is involved in the construction of permanence in architecture?
How are outdoor landscape and indoor sensuousness connected?
How is the concept of flexibility linked to the one of permanence in architecture?
How should functionality adapt in time?
How should clients be involved in the dwelling design?
In which measure?
How formal aspects influence the perception of home?
How to apply the theory to the practice of a project for a new dwelling complex in the area of Ronchetto S/N, at the borders of Milan?

existing kindergarden

Extension of
existing urban park
(±0,00m)

Existing parking area
(±0,00m)

Existing dwelling

New dwelling

New dwelling

New dwelling

Template apartment

Alteration 1

Alteration 2

Courtyard
(+3,00m)

Alteration 5

Alteration 3

Alteration 4

New pedestrian path
(±0,00m)

Alteration 10

Alteration 9

Alteration 7

Alteration 6

Alteration 8

New car path
(±0,00m)

New public square
(±0,00m)

Extension of
existing urban park
(±0,00m)

Connection
with Milan
city centre

Connection with
Villa Beltrani

Connection
with Milan
suburbs

Connection
with Parco
delle Risaie

existing football field
(area of future development)

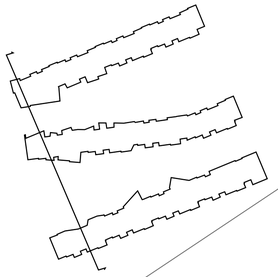
HOME - TECTONIC OF THE CONTEMPORARY DWELLING
Egle Costantinopoli - MSc04Ark01 - Long master thesis - May 2015
First floor plan 1:500 - emphasis on the apartments alterations ^ N

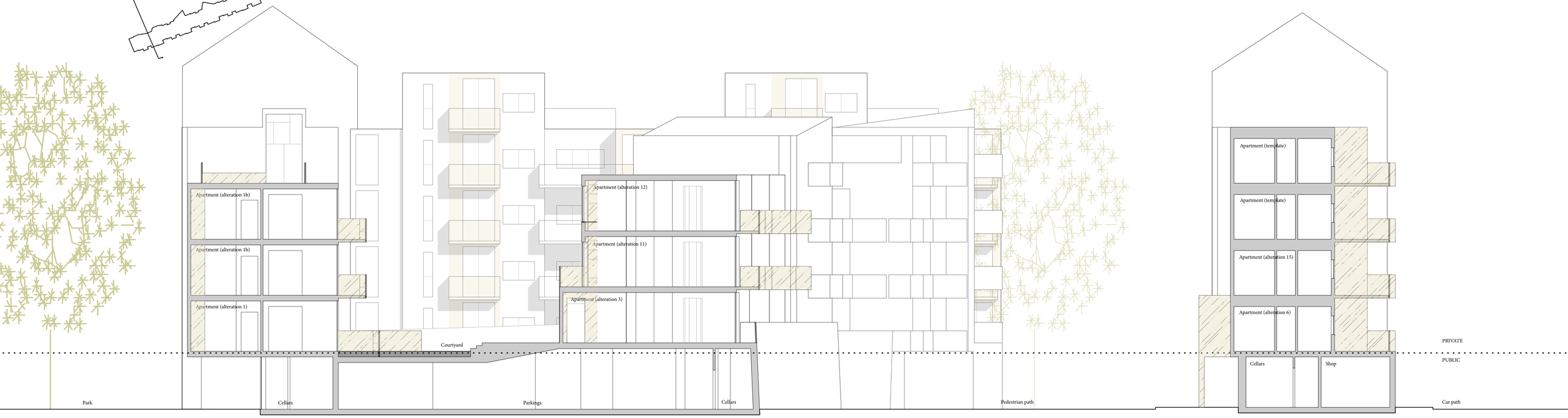
1

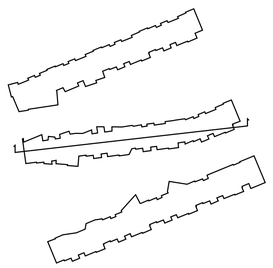
HOME - TECTONIC OF THE CONTEMPORARY DWELLING

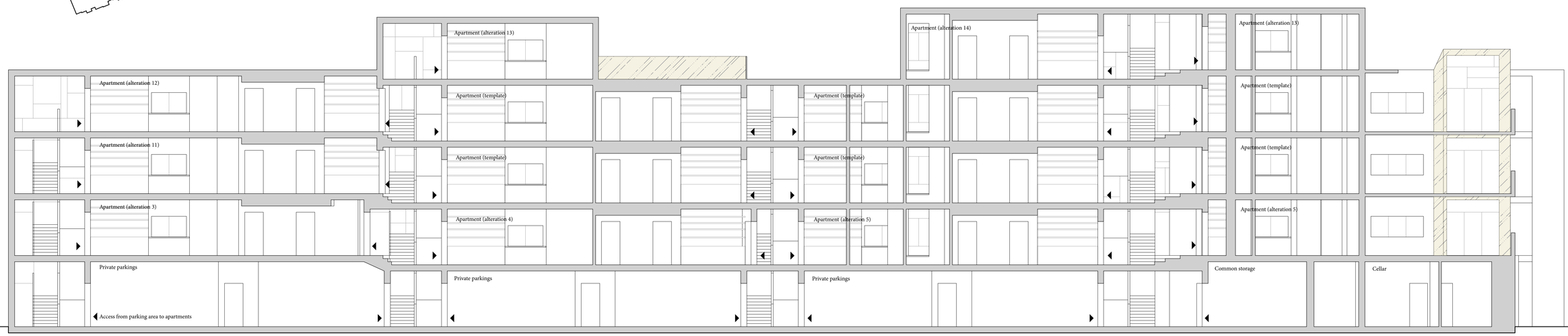
Egle Costantinopoli - MSc04Ark01 - Long master thesis - May 2015

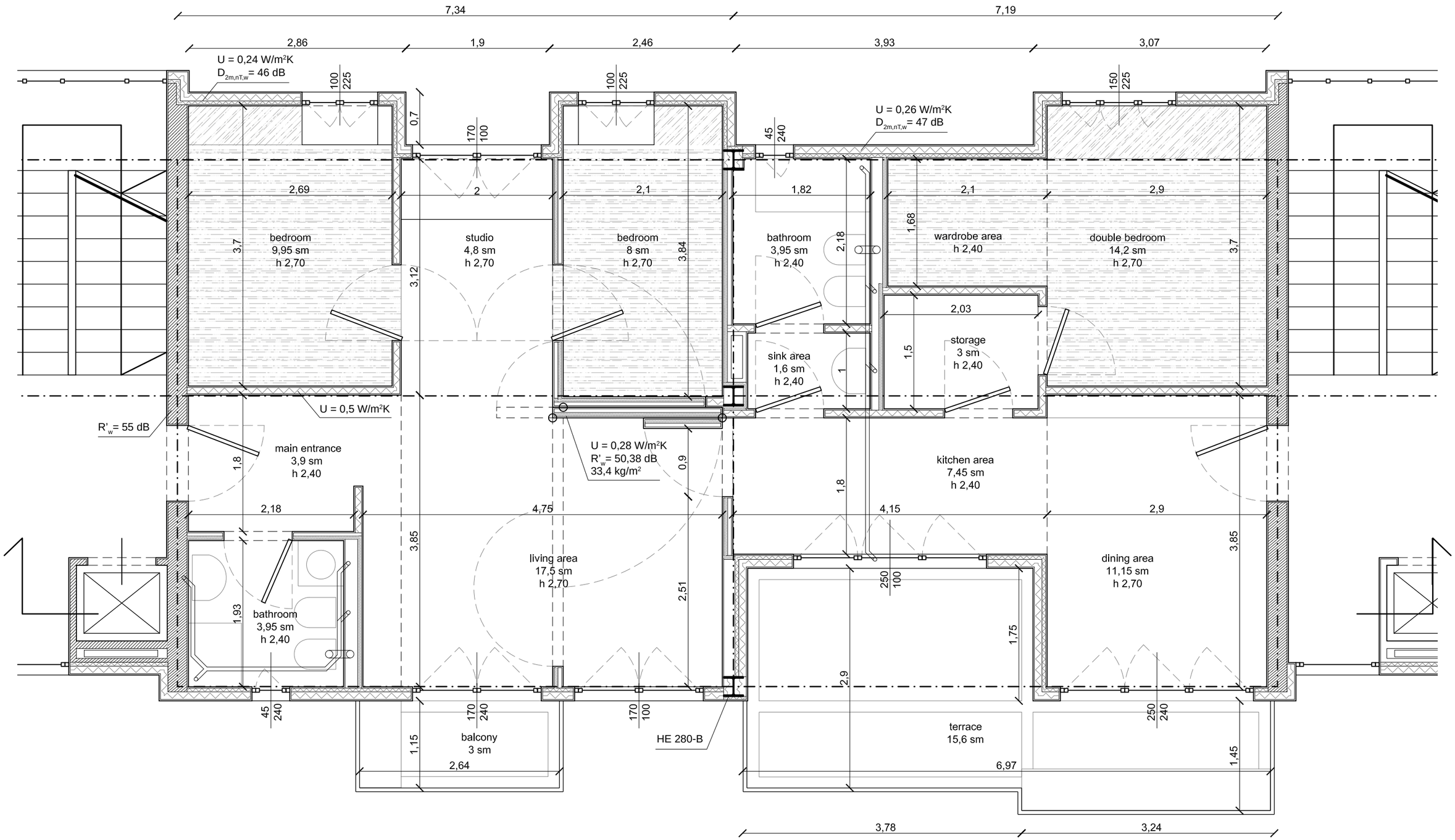
First floor plan 1:100 - zoom on the courtyard ↗ N



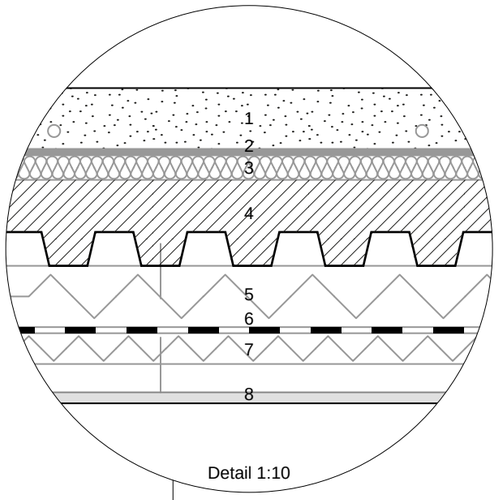

Apartment (alteration 1b)
Apartment (alteration 1b)
Apartment (alteration 1)
Courtyard
Apartment (alteration 12)
Apartment (alteration 11)
Apartment (alteration 3)
Apartment (template)
Apartment (template)
Apartment (alteration 15)
Apartment (alteration 6)
PRIVATE
PUBLIC
Park
Cellars
Parkings
Cellars
Pedestrian path
Cellars
Shop
Car path




Apartment (alteration 13)
Apartment (alteration 14)
Apartment (alteration 13)
Apartment (alteration 12)
Apartment (template)
Apartment (template)
Apartment (template)
Apartment (alteration 11)
Apartment (template)
Apartment (template)
Apartment (template)
Apartment (alteration 3)
Apartment (alteration 4)
Apartment (alteration 5)
Apartment (alteration 5)
Private parkings
Private parkings
Private parkings
Common storage
Cellar
Access from parking area to apartments

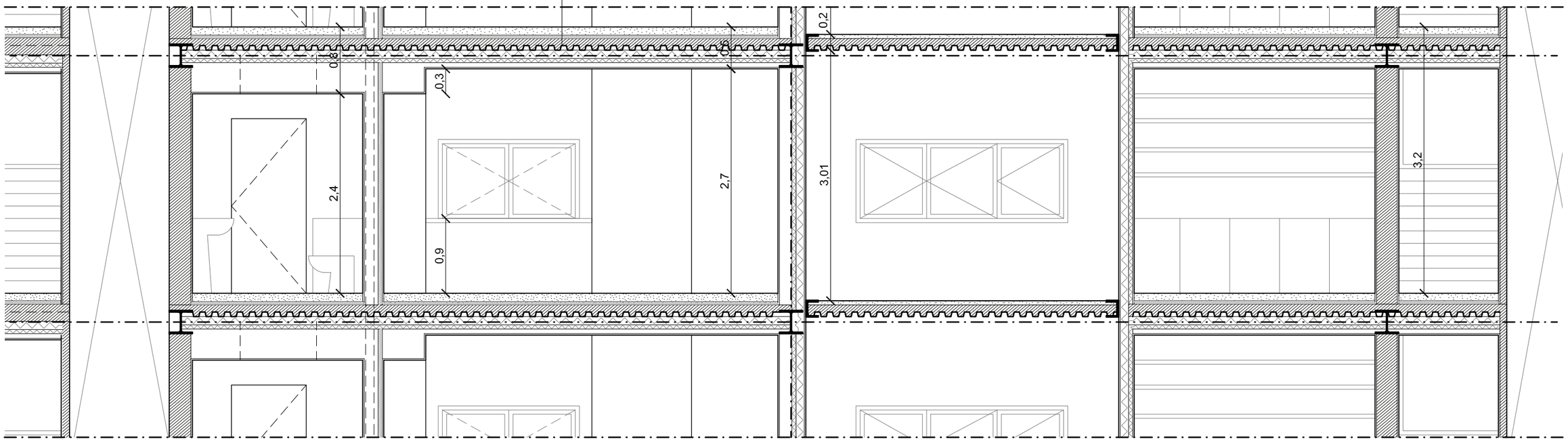


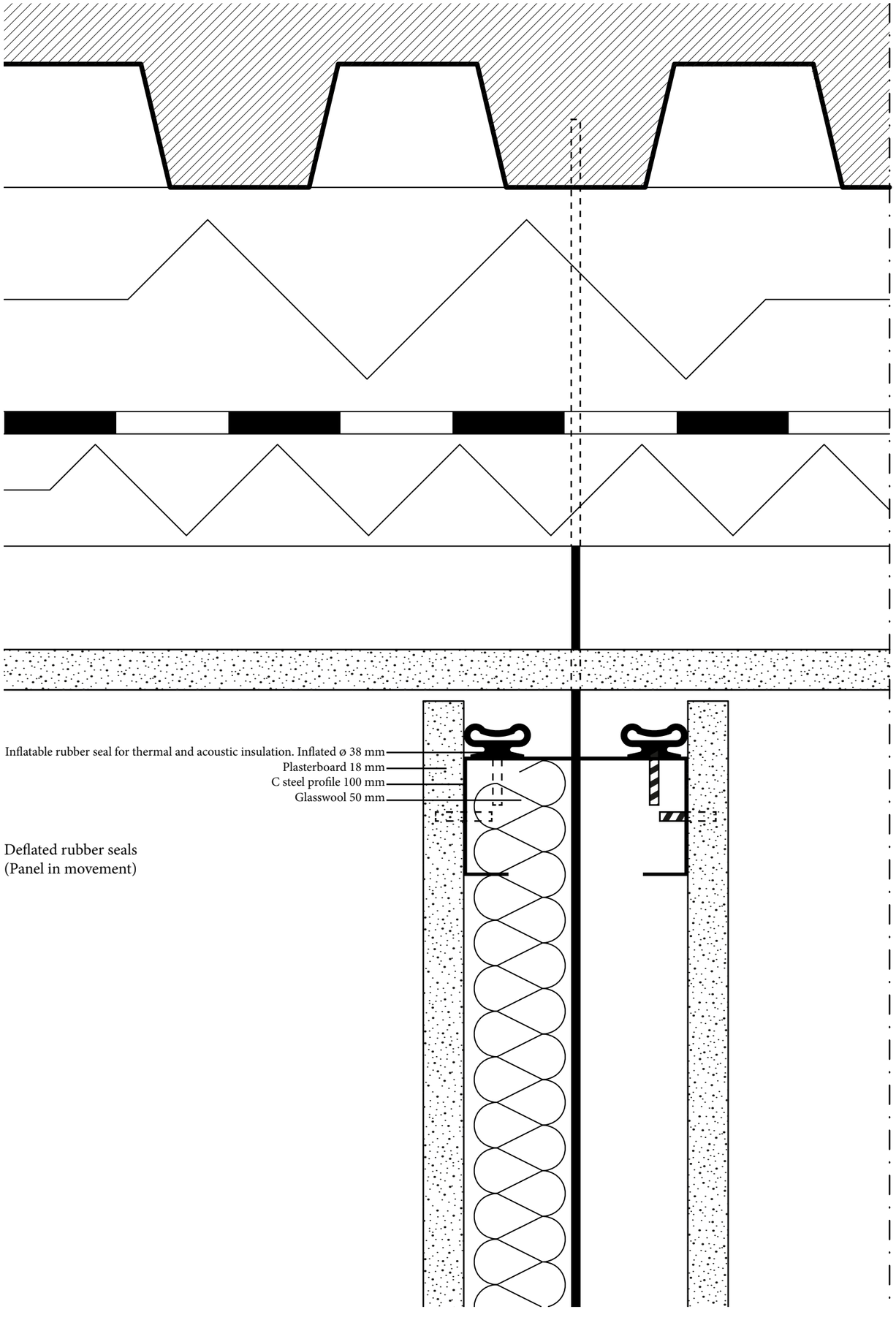
HOME - TECTONIC OF THE CONTEMPORARY DWELLING
Egle Costantinopoli - MSc04Ark01 - Long master thesis - May 2015
Floor plan of the template apartment 1:50 N



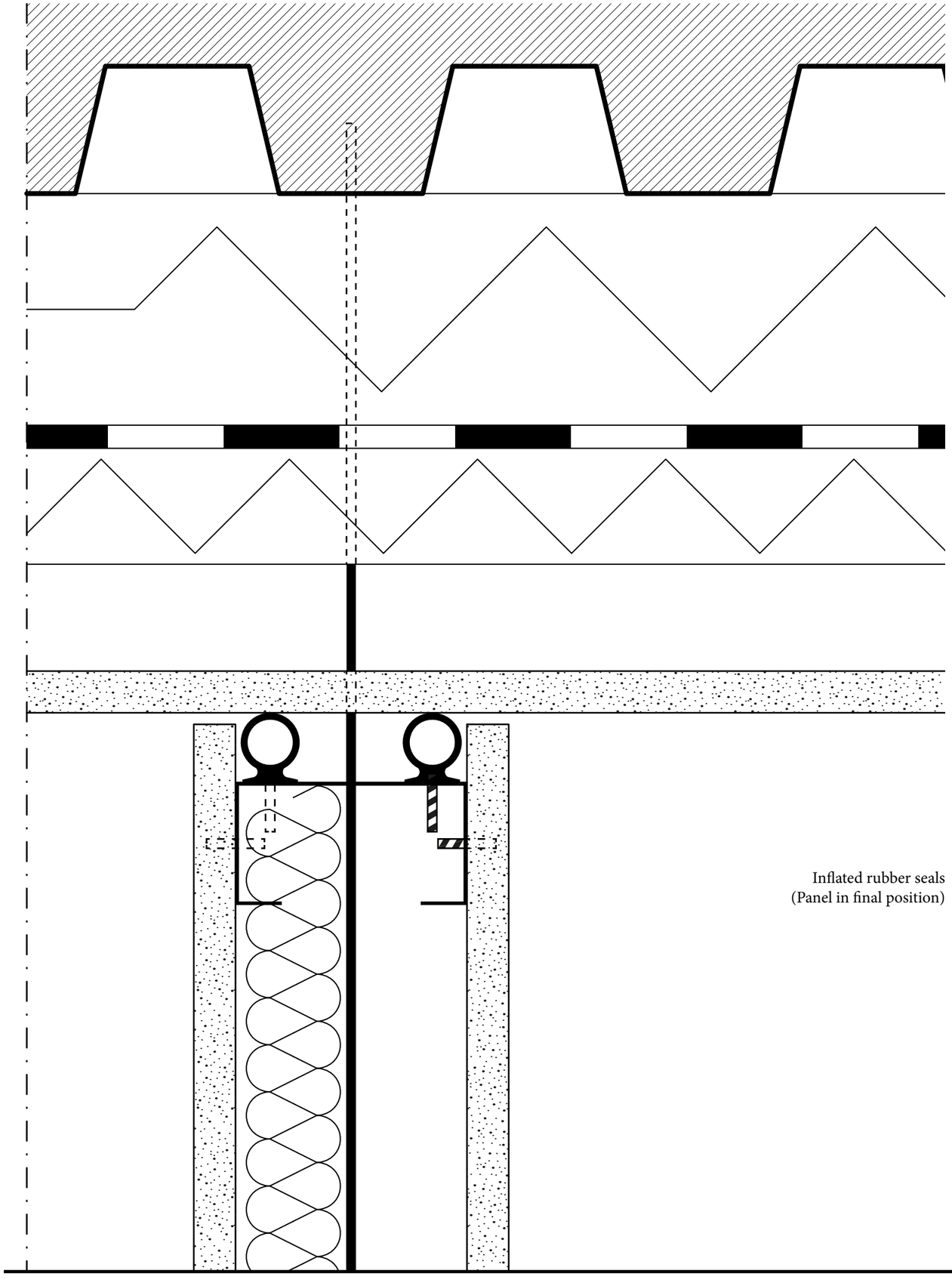
Detail 1:10

1 - Light concrete flooring with floor heating (100mm)
2 - Fabric layer for step sound insulation
3 - Sundolitt acoustic insulation panels (40mm)
4 - Reinforced concrete slab on corrugated steel sheet (140mm)
5 - Polysterene thermal insulation (100mm)
6 - Vapour barrier
7 - Polysterene thermal insulation (50mm)
8 - Plasterboard cladding (18mm)





Deflated rubber seals
(Panel in movement)



Inflated rubber seals
(Panel in final position)