ELASTI-CITY

A study of adaptability across city scales.

by

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Abstract

Elasti-city is an urban model generated with the purpose of satisfying current and future needs. Potentiating the dynamic properties of urban environments can transform them into adaptable ones. Understanding the city as an ever-changing environment allows architects and urban designers to read in urban complexity other than its current problematic. Buildings, and by extension cities, that are adaptable can provide solutions to multiple issues, generate vibrant urban life and permit people to mold and transform their surrounding environment.

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1. Introduction

Cities around the world are changing fast. Understanding “change” as a constant quality of urban environments is essential for disciplines such as architecture; urban design and planning that participate in the making of cities. As a consequence, these disciplines have started to redefine their professional boundaries and blend into each other. Architects can no longer ignore the role that individual buildings play in the creation of the city while planners have to recognize the effect that policy has on architecture. This is evidence of the importance of developing holistic analysis and design methods that address diverse urban scales. While talking about scale, it is essential to remember that cities are inhabited by people with individual needs, dreams and desires. As people act on these needs, they dynamically participate in the creation of the city. For this reason there is a need to address change at large and small scales.

This research project provides an understanding of the city from the architectural perspective with a focus on people’s participation in the creation of vibrant cities. Architecture is used as the mediator between the large urban scale and the small scale of the city dweller. In order to understand the city and its continuous transformation, this research proposes methods of analysis that use the existing city as a laboratory to explore diverse scales, dissect urban phenomenon and allow the extraction of design principles. These explorations evidence the need to provide models for analysis and design based on achieving a greater degree of adaptability. Environments that are able to adapt to changes through time will have a better change of extending their functional life. Thus, this thesis proposes an alternative urban model to that of conventional practice called Elasti-city, which aims to provide tools for the design of adaptable cities and buildings. Elasti-city’s objective is to generate scenarios for the unexpected, provide spaces of opportunity for spontaneity, adaptability, reinterpretation and appropriation of the city.

1.1 **Motivation**

Spontaneous urban development occurs in every city regardless of the rigidity with which the urban environment is designed with. People adapt to the existing conditions and modify them to satisfy social, economic and cultural needs, and by doing so they participate in the creation of the city. This thesis is inspired by the adaptability achieved as a result of participation, and the way in which it converts rigid environments into vibrant ones. Cultural public expressions, unplanned activities, social gatherings and temporary uses are clear manifestations of people’s will to transform the places they live in. These spontaneous activities tend to happen in neglected spaces, areas that are residual, unused or underused and where policy and regulation is relaxed enough to allow people to take over.

A closer look at spontaneity in the city starts to show the science behind this phenomenon. It becomes evident that it is not a casualty but a series of interconnected elements that make it happen. The existence of a neglected space with some very specific qualities in combination with a need that is not being satisfied, are two of the many components that catalyze spontaneity. This thesis looks forward to studying the conditions that make a city adaptable in order to generate unplanned activities and uses that are not only displays of a vibrant urban life but also provide a more efficient use of urban environments.

1.2 **Problem Statement**

Cities face diverse issues such as dramatic changes in population, mismanagement of resources, inequity, and pollution, among others. Moreover, many cities are designed with a sense of urgency responding only to present needs without recognizing the need to adapt to future changes. While it is important to respond to urgent mat-

ters it is also essential to provide open-end solutions that evolve over time and adapt to changes in the future. Therefore the overall problem identified in this thesis is a lack of adaptability to many of these solutions. A city is dynamic, nevertheless numerous of its components are static and don't respond to change. In addition, contemporary cities follow a top-down approach where people have a limited input in the creation of the places they live in.

Figure 1. Negotiation of large and small scale.

1.3 **Hypothesis**

The thesis follows the hypothesis that potentiating the dynamic properties of urban environments can transform them into adaptable ones. Understanding the city as an ever-changing environment allows architects and urban designers to read urban complexity in terms other than its current problematic. Buildings, and by extension cities, that are adaptable can provide solutions to multiple issues, generate vibrant urban life and permit people to adapt and transform their surrounding environment.

1.4 **Objectives**

The aim of this thesis is to generate methods of analysis and design that deal with change and adaptability of urban environments at diverse scales. Through the study of diverse theories, observation of contemporary cities and use of different mapping techniques, this research looks forward to identify the mechanisms that allow cities to be transformed in response to diverse forces of change. Ultimately, the lessons learned from analysis and research, are intended to provide useful tools for responsive, adaptable and participatory architectural and urban design.

1.5 **Scope**

This thesis explores the topic of the adaptability of cities though the exploration of diverse theories, observation of urban phenomenon and site analysis. While the focus is to explore urban environments this is done by studying the architectural scale and its interface with the public realm. In other words this research provides an understanding of the city though its architecture. Moreover this work offers a wide rather than specific and narrow understanding of the issues of change and adaptability. This thesis looks to open up the question of how cities could evolve and respond to upcoming challenges.

1.6 **Methods**

This thesis uses the following methods of study:

Theoretical Background. The study starts by reviewing a diverse literature that provides an understating of the

theories that have influenced the manner in which cities have been built and designed until now. Then, the research focuses on identifying the major issues affecting cities around the world, providing a clear picture of the challenges to be addressed in cities. Finally, a third part of the research studies literature regarding urban transformation, adaptability and flexibility.

Case Studies. Three case studies are used to reference buildings and cities that are adaptable and flexible. These examples are living proof that the built environment, when designed for it, can adapt to diverse changes through time.

Analysis and Observation. Initial observations focus the analysis on urban phenomenon. These observations allow identification of general spatial components that allow adaptability. These studies are done at the city, neighborhood, block and building scale. Through the observation of phenomenon related to urban adaptability, principles for design are extracted.

Intervention. Once principles of adaptability are identified the next step is to apply them to a design project at the architectural scale. This allows a demonstration of how adaptable principles are manifested in built form.

1.7 **Structure**

Chapter 1. "*Introduction"* presents the research topic, problem and hypothesis. This section also exposes the objectives and methods used throughout this thesis.

Chapter 2 – "*The City"* contains the literature review and discusses the views that different authors have of the city. The study and comparison of the diverse methods of analysis proposed by these authors is also presented. This is followed by an explanation of the specific position that this thesis has regarding the future of cities. This section also exposes the main issues currently affecting cities around the world. Overall the first chapter sets the theoretical ground for this research.

Chapter 3. "*Elasti-city"* discusses the topic of adaptability as the predominant issue of urban environments, explores existing literature and reviews case studies relevant to the research matter. The theoretical model of Elasti-city is presented in this section as a model for the creation of sustainable and adaptable cities.

Chapter 4. "Methods" presents the diverse methodologies used from research and analysis throughout this thesis. This chapter also includes initial observations of everyday phenomena of elasticity.

Chapter 5. "*Analysis"* observes elastic and adaptable urban phenomenon on diverse scales. This section contains numerous diagrams and maps that allow an understanding of the information extracted though site analysis graphically.

Chapter 6. "*Intervention"* demonstrates the application of elastic principles and the design process for an elastic building. A building is designed using principles of Elasti-city and different scenarios are tested in order to demonstrate how the building adapts to diverse forces of change.

Chapter 7. "*Conclusion*" evaluates the methods for analysis and design application of Elasti-city. This section also provides suggestions for future studies.

2. **City**

As the world becomes urbanized and cities grow and transform, it seems urgent to redefine the word "city". Urban environments have grown not only in size but also in complexity; therefore "city" is no longer a simple concept that can be reduced to a few words or a short sentence. In an attempt to comprehend complex cities, complicated definitions have been generated. In contrast, others have over simplified it by compartmenting, sectioning and separating it into individual components without recognizing the larger system of interconnections that exist within the city.

The basic dictionary definition poorly illustrates the elements that compose the contemporary city, describing it as "a large or important town" (Dictionary.com), consequently it can be said that the city, in this basic definition, no longer exists (Koolhaas 963). As a response, many theorists have generated commonly used concepts that describe a larger and more complex type of urban environment. A good example is the "continent city" by Yona Friedman, which refers to various cities networked by fast speed transportation (75-93), one that surpasses any political, economical or physical limit. Many urban theories, such as the one by Friedman, are trial understandings of the challenges urbanization brings to architectural practice.

What is more, if the city is in continuous transformation wouldn't its definition do so as well? Are theorists and researchers wasting a ridiculous amount of time defining a concept that is so complex and unsteady? Moreover, the way in which someone defines a city depends on location, context and time, among other aspects. Mexico City, Shanghai and Sao Paolo are all cities that might have similarities in size and population; nevertheless, they are very different in terms of geographical location, culture, history and more importantly urban form.

While some have been obsessed with defining and, as a consequence, limiting the concept "city", others have opted to find an alternative "vision" of urban environments. A "vision" is a critical analysis of the present and past that allows looking into the future. Although it is important to acknowledge past conditions that affect cities today, these should not represent a limitation to the proposal of new urban models. Cities of the future should not be shadows of their past. A "visionary city" has been defined as a dream of the future (Maas 212), yet dreams can fall into utopia and never come to realization. It is central to find a balance between liberated imagination and reality. Today's urban visionaries should address past errors, respond to current needs and propose alternatives, if not new, ways of living in the city.

2.1 **Urban visions**

Many contemporary cities have been built based on the ideals of theorists, planners and designers. These "visions" which shaped cities in the past might not be adequate for today's conditions; however, it is important to understand them in order to propose urban models for the future. Thus, this thesis explores urban theories from different times and places which offer a good range of perspectives and methodologies. From this theoretical background, essential principles are extracted composing, collectively, the view that this research has on the city. The wide range of standpoints explored required a process of compare and contrast in order to identify similarities and differences. At first sight the theories studied seem to be very different, however these are brought together either by the vision they have on the city or by their methods of analysis which is why they are divided into the following categories:

Simplistic city. Reads the city by simplifying it. This view recognizes that complexity is composed of diverse individual elements which are to be categorized and isolated in a search for a more uncomplicated and controlled

city. Theories from modernism are located in this category. Le Corbusier's model for a contemporary city exposes a fascinating classification of the diverse components of a city, achieving great simplicity by means of separation and segregation. The initial problem with this model is that it is based on an "ideal site", ignoring existing cities. In addition, elements such as streets, which are complex systems that contain multiples modes of transportation and exchange, are divided in to several "streets of various stories each will have their own particular functions". This method of separation is applied to every element in the city. Finally, the element that "magically" links things back together is the car (Le Corbuiser 323-325).

Figure 2 has been removed due to copyright restrictions. The information removed include images of "Ville Radieuse".

Figure 2. Le Corbusier's vision for the city the "Ville Radieuse"

http://archidialog.com/2010/10/10/le-corbusier-ville-radieuse-2-not-so-conscious-inspiration/. Accessed: December 2010.

Nowadays is easy to criticize Le Corbusier's model, nevertheless in its time and context it challenged the way cities were designed. He recognized the need to adapt urban environments to technological advances caused by the industrial revolution. Another important contribution of his model is the identification of green space as an essential component of functional and healthy urban environments (Le Corbuiser 325).

Organic city. Admires the historic town. This model is considered to be organic because it "respects human dimensions". Every component of the city maintains a perfect balance with human anatomy; consequently its area corresponds to the distance a person would walk to get from one end to another (Doxiadis 393,395). The organic city is created "more or less spontaneously over many years" (Alexander 2), its consolidation occurs over time transforming from town to city.

Figure 3 has been removed due to copyright restrictions. The information removed include an image of a historic town.

Figure 3. Historic town as an model of admiration and inspiration.

http://www.rentalsaturnia.com/pitigliano-apartaments-engl.html. Accessed: December 2010.

Theorists such as Christopher Alexander argue that this model contains principles that can be applied to the development of contemporary cities, he states that “it is vital that we discover the property of old towns which gave them life, and get it back into our own artificial cities” (3). In this sense the Organic City represents a nostalgic view, Nowadays many urban designers, architects and planners consider this as an ideal vibrant, organized and sustainable urban model.

Scientific city. Unveils the science behind the creation of cities. This thesis identifies two main streams in this category. One stream studies the organic creation of cities from the past in order to build cities in the future. Christopher Alexander, in his text “A City is Not a Tree.” exposes the need to find the”abstract ordering principle” of cities. Alexander perceives the city as a complex system where everything is interconnected. Additionally he proposes a method of study based on a mathematical structure: a semi-lattice (Alexander 1-3).

Figure 4 has been removed due to copyright restrictions. The information removed include an image of Christopher Alexander’s semi-lattice.

Figure 4. Christopher Alexander’s semi-lattice, used to scientifically study cities.

http://1.bp.blogspot.com/_-LvpBoDIt4Q/SI4yLXs7uJI/AAAAAAAACds/xzIsRnmMWBM/s1600-h/semilattice.jpg. Accessed: December 2010.

In support of this idea, authors such as Salingaros and Doxiadis have developed other mathematical models to analyze the characteristics of organic cities with the objective of extracting principles that can be applied to future urban development without reproducing the past. Salingaros uses the idea of a fractal city where all scales are linked (3). In contrast, Doxiadis analyzes cities categorizing them first by size and second by dividing them into five elements: nature, man, society, shells or buildings and networks. He uses these two categories to generate complex correlation between them providing rich, but extremely complicated information (397, 393).

Figure 5 has been removed due to copyright restrictions. The information removed include images of the “Fractal City”.

Figure 5. Nikos Salingaro’s fractal city

http://mathieuhelie.files.wordpress.com/2009/02/complex-grid-fractal.jpg. Accessed: December 2010.

The second stream, in contrast, focuses on the contemporary city. Information is extracted and transformed into data in order to process it, creating new models in a digital world. This allows a testing of utopian scenarios and their impact in urban form. The group of architects MVRD is part of this stream. One of their earliest proposals, Metacity-Datatown acknowledges the interconnection between elements and resources that compose a city, such as population, land, water, waste and food, among others. This is explored by extracting data from a specific country, The Netherlands. The correlation between data is expressed mathematically and on a three-dimensional model where imaginary scenarios are tested (MVRDV 18). This playful method allows visualizing the impacts that diverse ways of living generate on urban form. Some of the scenarios are generated by simple questions: how would a city look if everybody lived in a high-rise building? How much land would be needed to feed the population of a city if everybody was vegetarian? Therefore, MVRDV not only contributes to the discussion of the city with an alternative view but also proposes an interesting methodology based in the advances of digital technologies.

Figure 6 has been removed due to copyright restrictions. The information removed include images of MVRDV's "Data Town".

Figure 6. MVRDV's datatown

http://www.mlcstudio.co.uk/blog/tag/meta-city-data-town. Accessed: December 2010.

By-the-book city. Controls and regulates urban development. This model is commonly used by planners rather than by theorist and designers. Planning policies, codes and regulations are the basis of the Controlled City. Planners generally rely on totalitarian design and control in order to generate functional cities; as a result this frequently constructs sterile environments with no place for "diversity, vitality and humanity of everyday city life" (Rogers 10). Standardization is one of the main objectives in most planning codes such as the Form Based Code.

Form Based Code was created as a response to rigid zoning regulations. Its intention is to provide a flexible alternative for restrictive planning while it standardizes urban form. It results in an instruction manual, a catalogue which offers a very limited array of variations for buildings, streets and open spaces. An example of this is the Smart

Figure 7 has been removed due to copyright restrictions. The information removed include images of a Form Base Code regulation.

Figure 7. Example of form base code regulations.

http://www.pioneerplanning.com/?cat=15. Accessed: December 2010.

Growth code which regulates elements at all scales (smartcodecentral.org), it "seeks to codify form in a straightforward way so that planners, citizens, developers, and other stakeholders can move easily from a shared physical vision of a place to its built reality" (Katz 1). Therefore it reduces diversity by standardizing buildings, streetscapes, neighbourhoods and ultimately cities.

Although the code follows ideals of a compact development with a good mix of uses, and intends to set some guidelines for urban development, it goes too far by defining the correct aesthetic a city should have. Form is not the only element that brings diversity to a city, although it is one of the most important elements used by architects and urban designers. If architects and designers can't manipulate the shape of their buildings and urban designers can modify streetscapes, are these professions becoming irrelevant? Moreover, how the users manifest their desires and individuality if everything becomes regulated?

Supporters of Form Based Code claim that it is based strongly in participation of the community where people are involved in design workshops, and charettes (Spikowski and Maddenand 3). These participatory techniques might recognize some of the needs of a community, but are far from overcoming the top-down approach, where a few from the top create the city where many people, at bottom, will live in.

Green City. Intends to bridge the gap between urban and natural. It took many years and Al Gore's film "An Inconvenient Truth" for human kind to realize that the environment is being depleted. Although environmental degradation is nothing new for ecologists and scientist, it is a novelty for architects and planners. Richard Rogers states that "it is a shocking revelation, especially to an architect, that it is our cities that are driving this environmental crisis" (Rogers 3). Therefore the future of our planet is jeopardized not only by human inhabitation, but by the way cities function.

Figure 8 has been removed due to copyright restrictions. The information removed include images of MVRDV's "Green City".

Figure 8. Example of a "green city" by MVRDV

http://www.matternetwork.com/2008/12/dutch-firm-wins-design-competition.cfm. Accessed: December 2010.

The world is rapidly shifting from rural to urban (Davis 19). Furthermore, cities contribute in many ways to the degradation of the environment. The excessive manner in which an urban population uses and disposes resources generates pollution of the air, water and soil (Power 364). Additionally, the dispersed locations of activities, in both developed and developing cities, imply large motorized displacements that also pollute the air, and require energy and resources. This separation of activities is also leading to the creation of division in societies, increasing inequity that reinforces environmental dilapidation (Rogers 7, 27). These are just some examples of how unsustainable lifestyles practiced by an increasing population are affecting the natural resources we depend on.

As a response to the facts mentioned above, architects, planners and theorist are coming up with alternative

ideas for urban development that accommodate the population, protect the natural environment and wisely use available resources. The Green City's ultimate goal is to find a balance between urban and natural environments (WCED 341).

Complex city. Defines the city as a complex system of interconnected scales and elements. Although the individual elements have their own importance, these are directly influenced by their connection to the whole. Jane Jacobs supports this idea by stating that in order to study cities they need to be understood as "problems of organized complexity" (433). Jacobs analyzes urban environments by this principle, her explorations look at various elements simultaneously and then discovers how one affects the other (422-433). She unveils interrelations between built form, economy, safety and people, to name a few. Yona Friedman takes the next step by studying interconnections not only within cities but on a continental scale. These two authors show that complexity and interconnectedness are evident at all scales whether you study a neighbourhood, city or a whole continent.

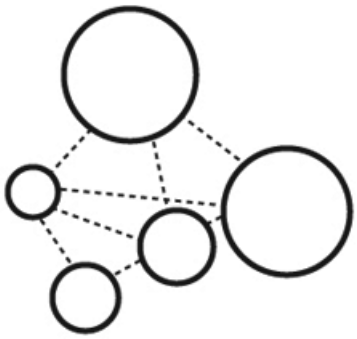


Figure 9. A complex system of interconnected scales and elements.

Observations and studies of the city such as the ones by Jacobs and Friedman evidence the way in which every single element, no matter how big or small, represents a key piece of a larger system. Therefore understanding cities as a whole requires the observation of elements at diverse scales, city, neighborhood, street, block, lot, building and dwelling unit to name a few. Moreover, theories of complexity recognize that individual components need to be studied not only in isolation but also and more importantly in relation to their connection to other components.

From vision to principle. After reviewing these six urban visions and understanding their attachment to a specific time and place, it is evidence that models from the past cannot be directly applied to the present or future in a successful way. Although it isn't possible to duplicate the conditions that allowed them to thrive, it is very important to learn from such models by extracting their fundamental principles. A principle is "an adopted rule or method for application in action" therefore it works as a basic guideline that is open to many interpretations. Principles can adapt to time and place, these can provide a look into the past, while understanding the present and looking into the future.

The “visions” presented above not only explored diverse urban models but also grouped them according to the principles they defended. These visions were purposefully selected due to their impact on contemporary cities. Therefore extracting the fundamental ideas that formed these models provides a solid ground to build a new vision. The following principles show the main ideas extracted from the Simplistic, Organic, Scientific, By-the-book, Green and Complex Cities.

Simplistic principles. This thesis argues that cities are complex and not simple. Nevertheless, from this stream of thought an important method of analysis can be extracted. Dissecting the city in its individual elements is part of the process of understanding urban environments as a whole.

Organic principles. Participation, participation, participation. This thesis doesn’t intent to replicate historic cities. Nevertheless, the organic development of these settlements was based on people’s participation. Participation is an essential factor that made these environments socially sustainable. Therefore participation needs to be reintroduced in contemporary cities.

Scientific principles. Studying the science of urban environments is essential to the proposal of new forms of development. This thesis proposes to learn not only from theories but from the city itself. However, instead of looking at the historic city this research looks at the contemporary city identifying its qualities and deficiencies. While qualities of a city provide principles to follow, deficiencies are spaces of opportunity to be improved.

By-the-book principles. Codes and regulations are necessary in contemporary urban environments. Large cities of today can no longer be fully organic; they need direction from people with knowledge and expertise. Nevertheless, this direction needs to allow for a larger degree of flexibility that promotes people’s participation in the creation of the city.

Green principles. It is clear that urban environments need to be designed in balance with the natural environment. Cities should promote more sustainable ways of living.

Complex principles. The idea of complexity provides one of the most important principles. This thesis views the city is a complex environment composed by the sum of many individual parts. Interconnection of these parts is what creates the city.

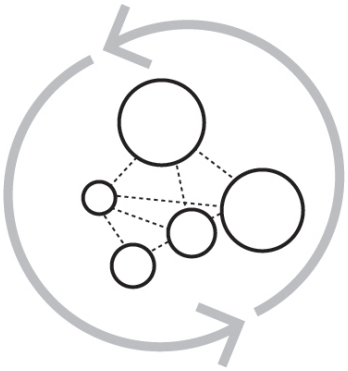


Figure 10. The city as a dynamic and complex system that contains numerous individual elements.

A new vision. This research understands the city as a dynamic and complex system that contains numerous individual elements. The significance of these parts relies on their contribution to the entire structure. This speaks of the diversity of scales that a city encompasses; ranging from the large scale which could be represented by the entire city, the medium scale of the neighborhood or even the small bench located in a park. All of these interconnected elements and scales compose complex urban environments of today. A lack of understanding of such interactions can lead to a misreading of cities.

2.2 **Urban issues**

Contemporary cities face numerous challenges generated by the fast pace of urban growth. Satisfying the needs of a growing population while lifestyle and consumption become more demanding is "virtually impossible" (Davis, The Urbanization fo the Human Population 26). In addition, globalization has triggered the competition between cities; as a result many efforts and resources are directed towards appealing to a global audience neglecting local and more urgent issues (Paddison 845). The issues exposed here support the conception of the city as problem; however problems can also be understood as a source of development. It is known that major advances have been achieved in time of economic, social or political crisis. In this sense urban problems can be approached from a productive standpoint.

Urban issues are different in each city according to cultural, social, political, geographical and economic characteristics; however, cities around the world share some challenges. This research project focuses in the commonalities between cities in order to provide an overall understanding of today's urban condition. The following are some of the main issues contemporary cities face nowadays.

People. It is a fact that we are facing an urbanized era. Urban population almost doubled from 1930 to 2000 and it is expected to double again by 2050, while the rural population is expect to decline in the same time span. Moreover, some studies show that overall population will continue to grow for the next 30 to 50 years, generating problems such as resource and waste mismanagement, social and economic inequity, environmental and climatic degradation among other issues (J. E. Cohen 1172-1173)

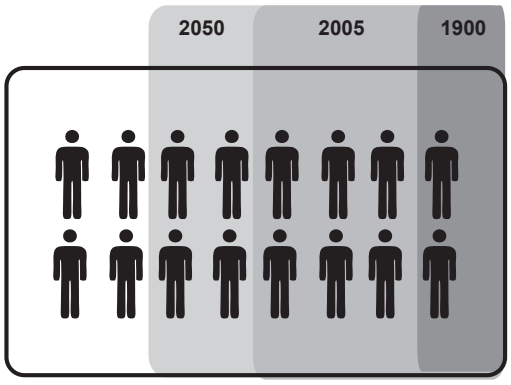


Figure 11. Urbanization or the world.

As urban population grows so do the cities people will live in. Therefore, urban environments are required to adapt in order to satisfy basic needs for new inhabitants. People need a place to live, work, study and recreate. Cities traditionally respond to this issue in two ways, increasing density or expansion. Density refers to the number of people that live in a specific area, thus increasing density means that more people will live in the same space that fewer people lived in before. Consequently, this allows a city to grow without expanding, protecting farmlands that surround urban land. Nevertheless, growth within the city tends to be complicated and expensive in contrast to developments on new land in the outskirts of existing cities, for this reason many cities grow by expansion.

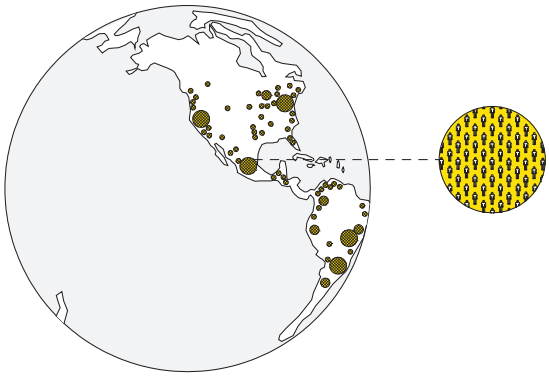


Figure 12. More people living on the same space.

Expansion seemingly offers an affordable alternative for growth, one that is attractive to investors who are not concerned with the provision of transportation networks, recreational spaces, and any other essential services. As a result, expansion generates marginal developments where people need to travel long distances to satisfy their needs, generating pollution and social segregation (Rogers 32-40).

In contrast to the idea of urban population growth, some studies show that world population will decline by the end of the 21st century, producing a whole new range of urban challenges (Lutz et al 544). This exposes the variability of the issues that affect the urban environment, where population fluctuation represents one of the essential factors for urban development. It is no longer enough to respond to issues of population only in terms of growth. It is imperative for planners, urban designers and architects to understand other dimensions of the problematic. With an overall aging population, people in the city will also get older and require other type of infrastructure or their lifestyles will change requiring different services; the diversity of issues that people bring into the city is enormous. Therefore, this research looks into population factors in a more ample manner. On one hand, current population growth needs to be managed in terms of its impact on society, culture, politics and the environment, among other factors. Secondly, cities need to respond not only to current needs but also to foresee and plan for future population changes and challenges.

Fear/control. Fear in cities is generated by the notion of “otherness” and losing control over ones surrounding environments (Body-Gendrot 352). Urban conflict and differences between people can be managed, for the most part, though the negotiation between people. However, as cities grow in size and diversity, these traditional and more organic modes of negotiation and city-making can’t solve issues at such a large scale. As a result, the re-

sponse to an increasingly urbanized world has being singular: control. Planning and designing cities with totalitarian control can lead to the creation of hostile and sterile environments.

Controlled planning practices are generating a disconnection between people and the city. In contrast, traditional urban development was strongly based on participation, a process that has almost disappeared from today's planned city. In the past, cities were "organic systems" that grew slowly, maintaining a good balance between humans and the rest of the natural environment (Tiwari 348). Maybe some of the last examples of organic and self-built environments are found in shanty towns throughout the world. These settlements can be considered as examples of traditional urban development; the scale of buildings, roads and open spaces in shanty towns have a closer relation to human proportions, elements that are equally found in traditional cities.

A common mistake is the belief that participation has to be eradicated in order to have organized settlements; doing so can turn the city into a rigid environment lacking personality, vibrancy and urban life. Urban plans and codes tend to standardize and regularize, these are either corrective or preventive measures against informal urban development. What is more, these formal modes of planning do not respond to the dynamism and variety of needs found in urban environments. Although informality without some structure can be problematic, providing some room for spontaneity and informal activities can stimulate cultural, social and economic development (Tiwari 348-350). Informal markets, for instance, temporarily transform a space into a cultural, social and gastronomic event while providing a service that has not been made available in a permanent way. Street vendors, musicians and coffee shops that spill onto the sidewalk are all components of a vibrant urban life. Therefore the real challenge relies on the creation of a model for urban development that generates some sort of order without creating sterile environments. Ideally a city should be functional and vibrant at the same time.

Furthermore, planners and their image of the perfect city have prevented other images from existing. Top-down approaches to urban planning are erasing diversity from contemporary cities. Construction codes regularize size, shape and aesthetics of buildings, leaving no opportunity for personalization or expression of individuality. Homogenization of the city commonly leads to the homogenization of society; it kills the social mixture that has generated art and culture. Cities for the future will require to plan for the "unplanned" (Tiwari 351) and by doing so they can allow for spontaneity and informality to be integrated into urban environments.

Scale. The size and complexity of the city are reaching "unprecedented levels of urbanization" (B. Cohen 68), generating great challenges to be addressed by planners, urban designers and architects. Nowadays cities face big issues. Masses of people are populating urban environments; larger distances need to be traveled forcing motorized transportation while great amounts of products are brought to satisfy consumption. Dealing with such large-scale issues is complicated. For instance, it is common to talk about people in a city in terms of population data, a simplistic way of understanding the specific needs of many individuals. Focusing exclusively on big scale issues ignores the existence of the small scale that provides a sense of individuality.

Big proportions are misunderstood and solved by constructing big infrastructures and buildings that are uniform and sterile. As stated by Rem Koolhaas "bigness is impersonal" (Koolhaas and Mau 513), consequently bigness kills the particularity and character of the small scale. Nevertheless the large scale generates residual blank spaces adequate for the insertion of small interventions. The residual spaces offer opportunities for infill development and appropriation where individuality can be freely expressed. While big neglects individuality; the small potentiates

it. Although Koolhaas refers to the building scale, his principles of bigness can also be applied to the city. Moreover, he argues that a building of a large scale can reach a state of bigness, subsequently it is no longer a single and cohesive constituent but a system of various smaller components. Therefore uniformity is no longer achievable and instead diversity takes place.

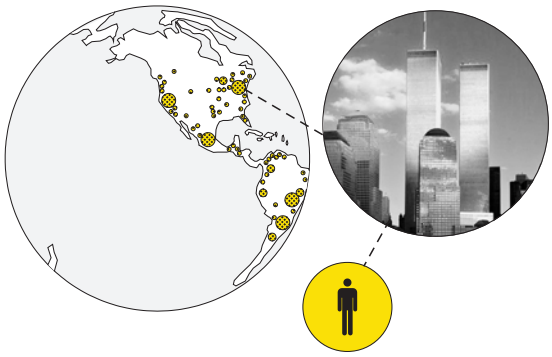


Figure 13. It is important to approach issues at different scales.

Understanding the large as a sum of individual parts is essential for the development of urban environments. Many urban planners have failed to understand the diversity implied in big issues. Analyzing today's city requires an alternative approach that understands the importance of the large but focuses on the small.

Environment. Cities require great amounts of natural resources to be built and sustained; additionally, urban settlements generate waste and pollution that deteriorate the natural. Many actions have been implemented as a response to these environmental issues, nevertheless the benefits are barely visible, and in fact carbon emissions have increased by about four times since 2000. Nowadays the demand of natural resources and generation of waste surpass earth's regeneration capacity by 25% (Fernandez 7). Therefore in order to stop environmental degradation and promote its regeneration, it is necessary to change and rethink the manner in which human settlements and especially cities function. Richard Rogers stats that future cities will be essential for restoring the balance of humans and the environment (4), a valid argument considering that half of the world's population already live in cities.

Dealing with environmental issues in cities requires action at least on two different levels. Large scale actions where city-wide infrastructure manages resources and waste in more sustainable ways at the same time that urban services such as transportation, garbage collection, access to open and green spaces allow city inhabitants to live in a better balance and contact with nature. On the other hand, it is also needed to promote actions in the small scale, on the level of the individual. Transforming urban lifestyles and people's daily practices can have a great impact on environmental improvement.

Planners, urban designers and architects, are faced with the challenge of creating cities and buildings that shelter and satisfy the needs its inhabitants while promoting more sustainable lifestyles.

Summary. Regardless of the issues affecting cities, a common mistake is focus only on urgent problems. Cities must

be designed and planned to prevent foreseeable future issues while solving existing ones. Elements in cities that are designed with too much specificity are hard to transform and to host other uses; on the other hand, designing with an excess of ambiguity can lead to underused spaces. Therefore, it is important to generate planning instruments and design strategies that satisfy current needs while providing space for future changes or demands.

It is evident that there is no recipe to solve the problems, thus it is important to approach them from a local standpoint. It is essential to understand the cultural, social, political and environmental context of a city in order to provide adequate solutions. Another aspect that is particularly essential is to approach issues at different scales. It is necessary to satisfy large scale needs of the population as a whole; this is done by providing infrastructure, services and planning guidelines for urban development. However, it is also important to recognize the individuality and specificity of each person by allowing people to be involved in the creation of the city. No Master Plan can respond to the demands of each person. Therefore, allowing enough freedom for people to customize and adapt urban environments can provide the means to satisfy individual needs. It is also a fact that cities are growing at such a fast pace that planning departments can no longer keep up with the tempo of change, for that reason relying on the population and more importantly guiding people to collaborate in the creation of their built environment can allow for a more efficient and socially sustainable transformation of urban environments.

2.3 **Conclusion**

Cities are complex by nature. Understanding such complexity requires professionals to develop new models of analysis that allow identifying the individual components of a city as well as their interconnection with other elements. What is more, cities are dynamic and humans are one of the main generators of such dynamism. Therefore studying the city involves observing human phenomenon; in other words, the study of the city cannot be isolated from its inhabitants.

Cities are in continuous change generated by large and small phenomenon. On one hand, cities must be able to address the issues generated by big challenges as well as the small and individual needs of each person.

Finally, the research done for this section exposes the fact that design and planning methods in the past have been effective in understanding large scale issues and providing large scale solutions while neglecting the small scale and slowly pushing away people's active participation. Finding a balance between large and small is imperative in the creation of functional and vibrant cities.

3. **Elasti-city**

The city is continuously evolving in response to the many issues that affect it; nevertheless, the overall problem is a lack of adaptability to these diverse forces of change. While construction or reconstruction of contemporary cities focuses on satisfying urgent needs, there is not much attention given to long term issues. What would happen to all these big buildings and infrastructure if population trends change? What if cities start to shrink? How would our cities adapt to future environmental changes? How do cities respond to needs and changes in the life of their inhabitants? While a city needs to be able to provide solutions to urgent problems, it also needs to start looking into the future and to be able to adapt, grow or even shrink.

Cities are in constant transformation, therefore, it is important to acknowledge the dynamic properties that generate change and design for it. A city that is not adaptable is more likely to fall into decay and obsolescence. This doesn't mean figuring out the future, nevertheless, cities need to be designed to provide spaces that are flexible and allow a multiplicity of uses and configurations. The concept of flexibility has accompanied many theories and models for sustainable design. Richard Rogers states that "buildings that are easy to modify will have a longer useful life and represent a more efficient use of resources" (74). While the idea of flexibility is strong it can also be very vague. Blank and under designed spaces commonly claim to be flexible since anything and everything can fit in them, but flexibility is not the same as ambiguity. Real adaptability requires a real purpose. A space, place, building or city becomes adaptable when it satisfies an initial purpose while allowing future transformations.

Adaptability is also found in spontaneity which occurs in every city regardless of the rigidity with which urban environments are designed. People adapt to existing conditions and modify them to satisfy social, economic and cultural needs, and by doing so they participate in the creation of the city. Cultural public expressions, unplanned activities, social gatherings and temporary uses are clear manifestations of people's will to transform the places they live in. These spontaneous activities tend to happen in neglected spaces where policy and regulation is relaxed enough to allow people to take over. A closer look at spontaneity in the city starts to show the science behind this phenomenon. It becomes evident that it is not causality but a series of interconnected elements that make it happen. The existence of a neglected space in combination with a need that is not being satisfied are two of the many components that catalyze spontaneity. The study of spontaneity can help us understand dynamism and adaptability of cities, providing a vibrant urban life and a more efficient use of urban environments.

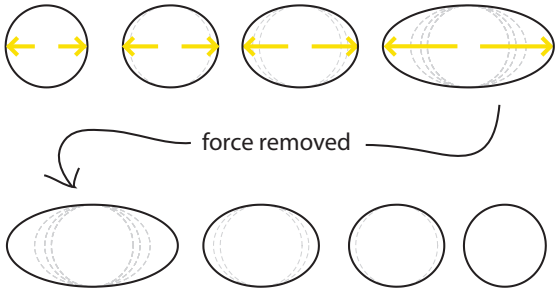


Figure 14. Definition of Elasti-city

While looking for alternative urban models that are flexible, adaptable and spontaneous it seems appropriate to use the term elasticity, which is "the property of a substance that enables it to change its length, volume, or shape in direct response to a force effecting such a change and to recover its original form upon the removal of the force"

(Dictionary.com). This definition, applied to buildings and the city, speaks of elements designed with specific qualities that can be transformed according to specific needs. It offers the adaptability of flexibility without its ambiguity. Additionally, an elastic urban model provides an opportunity to adapt not only to cities' growth, but also to shrinkage, or for that matter to any change.

From the concept of elasticity the model Elasti-city is generated based in the following principles:

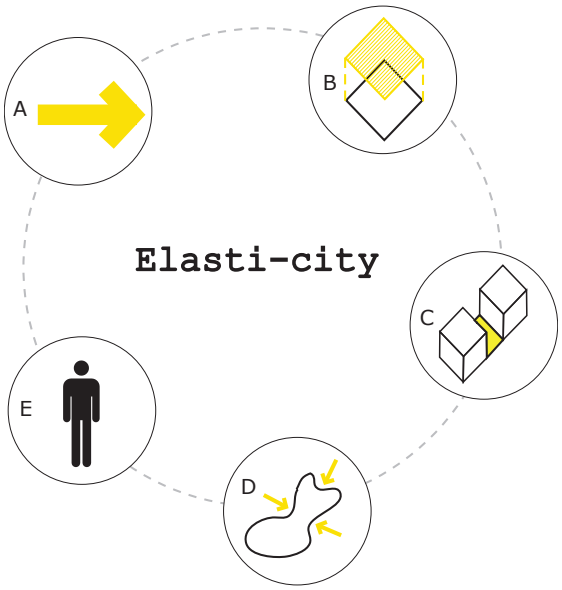


Figure 15. Principles of Elasti-city

a) Elasti-city is an adaptable urban model that follows the physical principles of elasticity. It is understood as the capacity of an urban environment to adapt to future needs while satisfying a current function.

b) Elasti-city is a complementary layer that is superimposed on existing urban environments bringing new levels of complexity and complementing existing sterile large urban developments. The term elasticity has been previously used in urban theory to define cities that "grow by a combination of in-fill development and the aggressive acquisition of new territory" (Meligrana 702). In contrast, Elasti-city denies the possibility of expansion by adding new territory; it is created within the existing city using the infrastructure that already exists.

c) Elasti-city finds its location in the residual space, urban void, unused building, empty lot or any other small spaces that have the potential to be claimed, adapted and given a new function. Elasti-city is only generated by a process of infill, renovation and regeneration.

d) Elasti-city is adaptable and able to support the stress generated by changes such as population fluctuation, technological advances and environmental issues. This is done by modifying existing building and urban stock and by promoting multiplicity of uses on every space.

e) Elasti-city it is a dynamic model that allows people to mould the city. It is a model based on people's active participation. Today's ideas of participation are very limited and rely on questionnaires, surveys or interview

to figure out what kind of cities people want to live in. This limited participation model processes, reinterprets and generalizes people's desires. In contrast, active participation allows people to freely shape and personalize their surroundings. Moreover active participation recognizes individual users and gives each one an opportunity to participate in the creation of the city.

It is evident that traditional urban models can no longer keep up to the fast pace of urbanization. Demolition, vacancy, and decay of existing buildings are an indication of a lack of adaptability in the built environment. Moreover new structures that rise to replace the old ones tend to be extremely specific in their intended use, and as a result rigid and difficult to adapt to other functions, technological advances and people's needs. For this reason there is a need for alternatives that allow cities to grow in more dynamic ways, responding to issues at large and small scales and in the long and short term. Elasti-city proposes an alternative vision or a principle to build in this way. It is a dynamic model that works as a cycle that keeps on reinventing itself by means of people's participation. Buildings and cities are conceived as dynamic structures, ones that respond to change and more importantly to direct manipulation by its inhabitants. The city is in continuous transformation, nothing is static and everything is temporary.

3.1 **Change, adaptability and flexibility**

Elasti-city is used in this thesis as a philosophy for design that acknowledges dynamism and change in cities. Change, understood as the "dynamic transformation resulting from evolutionary processes produced by actions and movements", occurs in urban environments on a daily basis (Gausa 445). With the passing of time, residential, commercial, industrial and office activities change their modes of operation, having a great effect on the built environment (Kincaid 155). For this reason cities and buildings, existing and new, must respond to these alterations by means of adaptability.

Elasti-city aims to understand adaptability of urban environments by means of the study of architecture and its implication in the creation of cities. Adaptability has been widely explored in architecture and is commonly referred to as flexibility. Adaptability is the ability to adjust a space over time according to users' changing needs (Schneider 287) and potentially allowing buildings to extend their life span (Bullen 20). It is important to realize that while adaptability permits multiple configuration or use of a space, it can be misleading and result in indeterminate and generic spaces that poorly satisfy specific functions (Gausa 228). Consequently adaptability should be composed by permanent and variable elements (Geraedts 1). Therefore, the permanent or "inflexible" must be designed to satisfy a specific purpose while the variable or flexible is to be adapted and modified through time (Schneider 287).

If one is to design for adaptability it is imperative to understand the types of changes that can impact the built environment. Some authors recognize "change of use" as a common transformation buildings go through, this implies drastic modifications in its structure, services, spatial configurations and building envelope to name a few (Kincaid 160). Although allowing multiplicity in use is important, it is only one of several aspects to be addressed by adaptability and flexibility. In a more comprehensive exploration of built form transformation, Slaughter states that buildings should be able to modify their functions, update systems to satisfy vitiating demands of capacity, allow for the modification of users' flow within and around the building (208). This second point of view provides a better understanding of the complexity involved in the creation of adaptable environments. Moreover, it evidences

the need to understand both the types of change and components that facilitate the adaptability of a space.

Buildings, in general terms, are composed by structure, envelope or skin, and services. Additionally, adaptability depends on the design of these component and their connections (Slaughter 209). There is extensive literature that provides useful strategies to achieve adaptability for existing and new structures, although authors differ in their methods of analysis they concur on the following recommendations (Geraedts) (Slaughter) (Schneider):

Independence of the diverse components facilitates modification of an individual systems without affecting the others.

a) Ease of access to services allows for their modification, replacement and update.

b) Generous provision of space offers an opportunity for adaptability.

c) Support structure must be disconnected from infill elements.

d) Structure of the building must be design to allow partition or connection of spaces.

e) Design efficient flow/circulation.

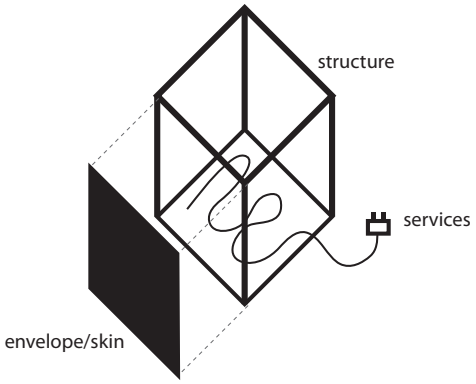


Figure 16. Basic components of buildings

These are some of the many aspects to address while designing adaptable buildings. Moreover if adaptability is a great challenge for architectural practice it is even more intricate when applied to the urban scale. One can say that a city with adaptable buildings will be, by extension, an adaptable city. What is more, cities need to be designed and planned in order to facilitate and promote flexibility. Policies and codes could ensure that buildings allow future changes through the creation of policy instruments that make adaptability a requirement rather than an option. In the same manner that the interconnection of smaller components of a building can facilitate future transformations, the relationship between the different elements of the city have a great impact on urban adaptability.

3.2 **Case studies**

The following case studies were selected based on their relevance in terms of adaptability while diverging in scale, context and time. Moreover, these are built examples that provide different information than offered by theory and literature.

Elemental. Housing complex - Chile

Elemental is a housing complex located in Iquique, Chile. This development was designed to replace one of the last remaining slums in the city where close to one hundred families lived. The site of the slum, as the city grew, became a very valuable piece of land which represented a risk for the permanence of its original habitants. Therefore the main purpose was to provide affordable and good quality low-income housing on a site that in economical terms no longer supported this type of development. The typology of choice was the row house which allowed for a more efficient use of the land (Ballesteros et al 54).

Figure 17.Location map of Elemental

Figure 18 has been removed due to copyright restrictions. The information removed include a photo of the self-construction process of Elemental.

Figure 18.Evolution of the self-construction process.

http://www.elementalchile.cl/. Accessed April 2010

The architects conceptualized the house as an investment that could increase its value overtime (elementalchile.cl). They took this concept literally into the design of the units where only half of the house was to be built and leaving specific space for expansion to be self built with materials of the user's preference. This strategy allowed for the units to be affordable at the same time that it integrated the concept of self-construction, a common practice of the slum inhabitants.

What is outstanding in this project is the consideration of change and transformation from the beginning of the design process. This allowed for the structure, envelope and services of the dwelling to be designed with adapt-

ability in mind. Moreover the flexible space permits expansion and modification to the original dwelling, at the same time that it strongly dictated the limits of such changes.

Ciudad Nezahualcoyotl. Master plan/policy - Mexico

Ciudad Nezahualcoyotl or “Neza” as it is commonly known, challenges the traditional ideas of formal or informal city by combining both concepts into one. Neza developed during the 1970’s outside the legal framework. In this neighborhood, land appropriation or purchase was based on squatting or illegal sales. Castillo, in the book The Endless City, speaks of the process of formalization of informal settlements, provided by the introduction of infrastructure and services such as water, light and sewage. On the other hand, he also notes that more formalized developments that are sprouting today at the edge of the city, tend to become somewhat informal though occupation (183). In this sense both formal and informal developments can potentially allow for a great degree of adaptability, customization and transformation.

Figure 19.Location map of Ciudad Neza

Figure 20 has been removed due to copyright restrictions. The information removed include an aerial image of Ciudad Neza and a photo of a typical Neza dwelling type.

Figure 20. Urban fabric and typical dwelling of Ciudad Neza

https://notasdelsur.wordpress.com/2008/02/21/neza-es-un-mapa-de-cuadritos/. Accessed: October 2010

Neza, as an informal development would suggest a disorganized and unstructured urban fabric, however looking at an aerial image of the neighborhood shows something very different. A well structured grid expands through the area generating long and skinny blocks. Major roads are laid out horizontally and vertically framing large quadrants of 5x20 blocks, each one of these quadrants contains a central node where infrastructure such as schools, markets, churches and recreational areas are located. This hyper rationalized urban structure contrasts with the informality and diversity of the building types that, for the most part, are self built structures that evolve over time

in relation to occupants needs. These buildings, where extended families live, result in hybrid typologies with a mix of commercial, residential and industrial uses. Moreover the lack of regulation in terms of use compatibility allows room for eccentric and very interesting combinations. In addition, informality permits services and commercial activities to sprout exactly where they are needed, in this sense this is the most responsive type of zoning or land-use plan one can find.

Ciudad Neza provides an example of adaptability that in one way fairly primitive, things happen almost by accident in spontaneous ways by having minimum regulation. On the other hand, this can also be seen as a highly develop model for city creation where connections and relationships between neighbors provide a flexible structure. These lessons taken from phenomenon of informality could be truly valuable if translated correctly to more formalized settlements.

PREVI. Housing complex/Building typology - Peru

In 1965 the Peruvian government in combination with the United Nations developed a programmed for the provision of social housing. PREVI is a neighborhood that achieved high-density with low-rise housing typologies, integrated the concept of growing house, and responded to the human scale as well as pedestrian movement. The clarity of the vision for the neighborhood provided a framework to be taken by the diverse local and international architects that designed the units and master plan of PREVI. Figures such as Christopher Alexander, Charles Correa and Aldo Van Eyck are some collaborators involved in this project (Garcia et al. 13).

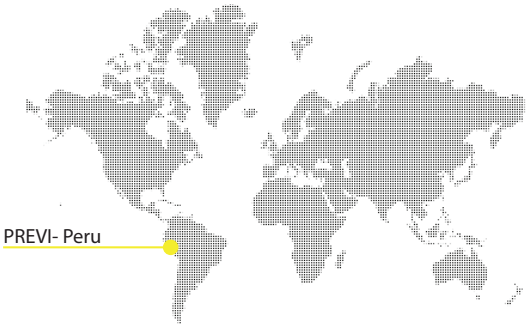


Figure 21. Location map of PREVI

Figure 22 has been removed due to copyright restrictions. The information removed include an image of the master plan of PREVI and a photo of the dwelling types.

Figure 22. Master Plan and evolution images of PREVI

Garcia et al., Fernando. Time Builds. Barcelona: Gustavo Gili, 2008.

The Master Plan for PREVI consists of 26 clusters with different housing typologies. Each cluster contains a central courtyard shared between neighbors. PREVI is also provided with services, civic, commercial and recreational spaces. At the building scale, each of the units was designed to allow future modifications or expansion. In terms of form, the devices that allow for transformation are buildings setbacks, courtyards, flat roofs and staircases. In this sense, transformation is facilitated though these devices but controlled and channeled, allowing the units to evolve over time without losing the quality of the house in terms of light-air and circulation (Garcia et al.).

Recent studies of the evolution of PREVI show that the houses have been able to grow in parallel with the families that inhabit the units. In terms of economic development, the units allow the inhabitants to insert their businesses into the dwelling or to generate separate units for rental. Thus, the house also provides the economic support for the family. In addition, the growth of the units facilitates densification of the neighborhood without altering the overall structure of the urban fabric. PREVI is a clear example of planned adaptability where informality is taken into account from the initial design stages, resulting in a neighborhood that has been able to successfully evolve over time.

Microrayon. Building typology - Russia

The microrayon is a social housing typology produced by the Soviet Union as a response to the high demand for housing after the Second World War. This typology was conceived as a model for prefab housing that allowed for fast construction while maintaining certain quality standards. The microrayon as a standardized product either forced people to adapt to the architecture or people transformed the architecture and adapted it to their needs, which is why this model represents an important example while exploring adaptability (Publik).

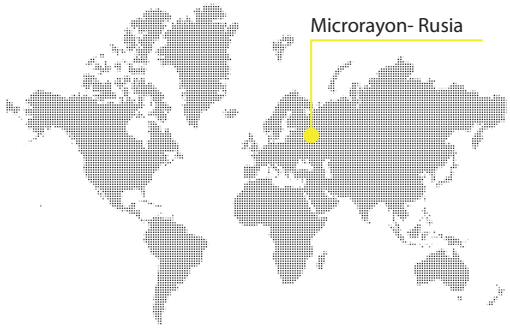


Figure 23. Location map of Microrayon

Figure 24 has been removed due to copyright restrictions. The information removed include an image of the master plan of a Microrayon and a photo of the dwelling types.

Figure 24. Master plan and examples of transformation in a Microrayon

Publik, Partizan. "Everyday Strategies and D.I.Y. Practices for Renewal Scenarios." Archis-Volume (2009): Apendix.

This housing type is both architecture and city. The population of a microrayon would be close to 150,000 people; therefore it would include services such as schools, health care, sports facilities and commercial spaces (Publik). In addition, the layout and organization of this typology evidences its connection to principles used later by modernists such as Le Corbusier. Skinny and long residential buildings were laid out around a courtyard designated as social and recreational space. In addition, services such as schools were usually placed inside the courtyard. Other elements such as hospitals, sports centers and commercial spaces were located in proximity to the residential uses. The structure of this architectural/urban typology was carefully planned resulting in rigid environments.

Microrayons were designed with a tight structure, however with the past of time they have been transformed and adapted by their inhabitants though diverse informal and do-it-yourself practices. Units have been subdivided increasing the original density of the buildings, courtyards and public spaces have been transformed and given new functions, extensions to the dwelling built up balconies or cantilever to the exterior. In some cases frames adjacent to existing buildings have been placed by the state, allowing for the extension of the building (Publik). These are a few of the many operations that inhabitants of microrayons have implemented through the last 50 years adding uniqueness to a very generic structure.

3.3 **Conclusion**

Through the literature reviewed and the cases studies it becomes evident that when the “change” is taken into account, buildings and by extension cities can be easily transformed and adapted to new requirements. Furthermore, it is important to think about adaptability of both existing and new structures. New buildings represent a minority, therefore it is imperative to develop strategies to update, repurpose and reuse existing building stock. Moreover, new buildings can be designed purposefully to integrate diverse uses, while old structures need to be evaluated in terms of the best compatible use to be adapted for.

A relevant observation is that people adapt built form to their needs regardless of the inflexibility of such structures. However, from the cases reviewed, the ones that addressed change and adaptability in their design require less effort and cost to be transformed. Designing with adaptability in mind also provides a more predictable urban form achieved by balancing flexible and inflexible space.

It is also evident that the topic of adaptability has to be approached from the urban scale. For this reason, urban design and planning must provide a base for adaptability.

In addition, the lessons learned from the literature reviewed and the cases explored, set a solid theoretical background to develop the model of Elasti-city. These observations also support the idea that adaptability is essential for the creation of cities that transform and respond to upcoming challenges and shifts in modes of living.

4. **Methods**

The literature reviewed and the cases studied in the last chapter set the theoretical ground for Elasti-city and provide a great range of ideas and suggestion for adaptable (and *elastic)* environments. However, the research previously presented demonstrates that much is still to be done in this topic.

The literature also provides more generic advice focused towards the technical aspects of buildings; it doesn't provide an illustration of the techniques and operations needed to modify such structures. Moreover there is a lack of study done on structures that have already been modified, which would provide valuable lessons on how to increase the adaptability of the built environment. Additionally, case studies are examples of Elasti-city in practice. Noticing the contextual implications are essential while looking at these examples. Cultural, social, political and economic factors have a great impact on the manner in which transformation to the built environment is executed. For this reason, it is important to define the purpose of the study and the type of information I desire to extract. If the intention is to obtain guidelines for adaptable design applicable in a generic manner, then it is essential to ensure that the local aspects of the study are separated from the global or generic ones.

Scale is another aspect to account for while studying adaptability; the components that allow for a building to transform through time are not the same ones that allow a block, neighborhood or city to achieve this same objective. In general terms, there is a need to increase the diversity in scale, context and focus of information available regarding adaptability. Although there are diverse authors talking about building transformation over time, they all seem to be focusing on the technical aspects, while the spatial qualities are for the most part ignored. Moreover, there is a lack of comparative studies on different scales of the city. For this reason this section is dedicated to the development of methods of study that, through observation and analysis, aim to increase the body of knowledge and provide guidelines to be included in the framework of Elasti-city.

4.1 **Methods and scales**

This research aims to collect and combine information from a wide diversity of sources. Literature, case studies and analysis of real life situations were gathered in order to generate a comprehensive body of knowledge for elastic and adaptable urban environments. Comprehending great amounts of information also implies the combination of research techniques that allow the synthesizing of information and translating it into a common language that facilitates correlation of data. The methods used for the analysis are the following:

Observation. Examination of everyday phenomena that demonstrate the manner in which people adapt a space to a use different from the original one is part of the methodology. These observations are located for the most part in public space or in the interface between public and private. This type of study requires a careful look at the spatial elements that allow for the allocation of such phenomena. This observation focus is on gathering and comparing quantitative and qualitative data. Moreover, the observations for this work intend to capture both "image and physical form" which refers on one hand to the essence of a space which has a subjective character and on the other to the objective identification of the physical qualities which are fixed and determined (Lyinch 27).

Diagrams and maps. The generation of abstract representations of the elements observed allows the simplification of very complex information. The diagrammatic technique used captures everyday experiences and transforms them into an axonometric drawing that allows one to look at the components of such an event in a more scientific way. Another technique used is the translation of data into maps that allow the correlation of location, space and numerical information into one graphic.

Dissection and extraction. Segregation of a single element of a complex system allows a thorough understanding of that specific component. Once the single element is analyzed it is possible to zoom out and analyze its connections with the rest of the system. Through this type of detailed observation, this research dissects the components of phenomena, buildings and cities in order to understand both, the qualities of each element and the interconnections between them. The dissection also allows the separation of generic qualities found in the object of observation from the contextual and specific conditions. In this manner dissection allows the extraction of fundamental principles applicable to multiple situations.

Data. The revision of data provides an overview of the geographic, economic, cultural, social and political characteristics of a place. Although data by itself can be shallow, when it is reinterpreted though mapping techniques it can provide very useful information. Data when given a spatial interpretation can be a practical for the design of cities and buildings.

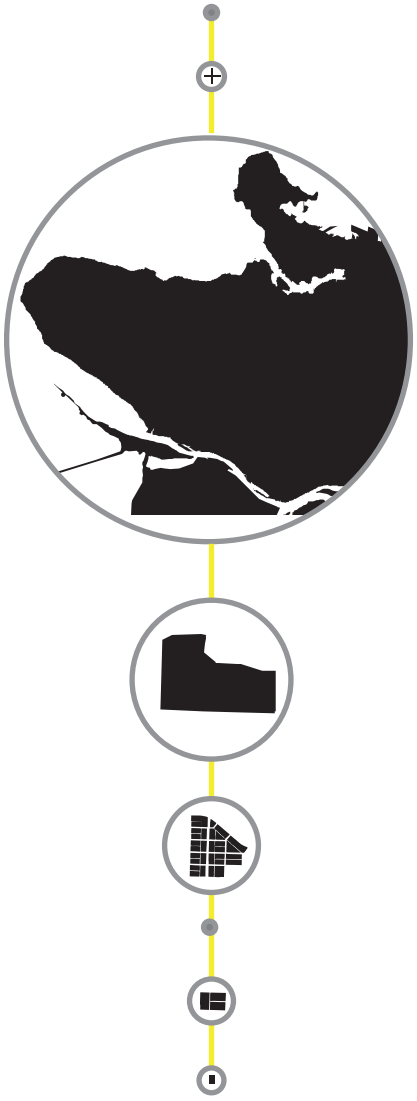


Figure 25. Scales explore in the analysis for developed for this thesis.

Critical analysis. Establishing a position regarding the matter of study is important because a position demands going beyond a merely descriptive analysis and moving into critical analysis. In addition, a critical approach to analysis allows figuring out the reasons behind a phenomenon. In other words critical analysis moves beyond the initial question of "what" and inspects "why" and "how" an event occurs.

Correlational research. Correlation of information allows overcoming the gap between diverse themes, scales and ideas. Through comparison and contrast, this research aims to find the connections that lead to the generation of new information. Moreover, this work also explores and correlates studies of different scales, times and places in order to provide a general theoretical base that could be applied to diverse and changing scenarios.

Scale. Exploration of diverse scales encompassed in the city allows for a wider understanding of urban environments. This research alternates between the city, neighborhood, site, block, lot, building and human scale in a non linear manner. The jump between scales allows the comprehension the individual elements the interconnection of the whole urban system. Figure 25 illustrates the scales studied for this thesis at the same time that it describes the process of analysis. The analysis of these scales is included in Chapter 5 and Chapter 6.

In summary, the combination of these techniques allows for the exploration of complex and diverse information where disparities seem to outnumber commonalities. Finding common ground is extremely important and relevant for this research as it aims to provide *elastic* principles that can potentially be applied to diverse conditions and contexts.

4.2 **Spontaneous phenomenon=elastic phenomenon**

This research sustains the idea that learning from the experience of quotidian events is fundamental in understanding the dynamism of cities. Reading the city from the ground, by walking through it and living in it, provides a different perspective, one that is close to the experience of the user. Jane Jacobs, with her observations and comments on North American cities, proved that one needs to walk and live in the city to get to know it (Jacobs). Furthermore this thesis aims to analyse life in cities with a scientific approach, this allows moving beyond the descriptive study and finding the rationale behind what initially seems to be a spontaneous phenomenon. The *spontaneous* is both produced by chance and self-organization. *Chance* is understood as a "field of possibilities" and *self-organization* as "the final phase of relations between systems that allows for adaptation" (Gausa 107, 542). Therefore, spontaneity is nothing but the by-product of a space open to possibilities connected to a series of social, cultural and economic conditions.

The initial analysis for this research focused on the observation of everyday events where people and communities modified both public and private spaces, to satisfy a specific need. These observations are located in Mexico, a place with very distinct cultural, social, political and economical factors that trigger spontaneous activities such as informal markets on a street, food stands on the sidewalks and all sorts of other commercial activities inserted into residential buildings. In a country like Mexico it is possible to witness the transformation of a residential area into a vibrant well served mixed-use neighborhood in the course of a few years. Commonly, restaurants, hair salons and karate studios appear in people's garages becoming the source of income for families while providing spaces for social interaction.

These interventions can fall into the category of informality due to their lack of regulation. Informality, defined as

Figure 26. Study of spontaneous phenomena in Mexico

"a dynamic that releases energies" (Gausa 343) liberates a series of dynamic interactions between people and the built environment. Informality and spontaneity are examples of a more elastic type of urban development with a" greater influence by the inhabitants" (Van Hinte et al. 14).

While observing the manner in which informal activities play with the existing conditions of a given space, it starts to evidence the rationale behind such phenomenon. Johnson in the book *Emergence* speaks of this as the "emergent intelligence of self-organizing systems" (Johnson 33). Moreover, revealing such "intelligence" or rationale entails approaching spontaneous and informal events in a scientific manner. Therefore, the following case study is scientifically explored in order to identify the elements that generate spontaneity, informality and elasticity.

Cell-phone man case. Spontaneous and informal activities are part of the daily urban life in countries such as Mexico. Informal commercial activities demonstrate the manner in which an individual can take over a public space, for instance the street, and adapts it to a function other than the original one. After observing several images of informal events, the researches focused on capturing one event and studying it in more depth (Figure 27). Initial observations on the particular case of the cell phone vendor identified that the state of disrepair of the street alters the urban environment while unleashing the possibility to repurpose a space that would normally be occupied by cars. Moreover an event that normally discourages economic activities now creates an opportunity for informality by liberating a small gap between the space in disrepair and the perpendicular street in use. This small gap happens to be adequate for a small scale vendor. What is more, it is important to notice the elasticity of this type of appropriation, which is achieved by means of a series of devices that can be easily assembled and disassembled allowing a temporary occupation of a space while allowing for it to return to its original state.

Zooming out and reconstructing the scene around this event allows identification of the elastic spatial qualities of this phenomenon. Figure 28 shows how the area occupied by the vendor is a small void, a left over space that has no specific function. This void is essential for the existence of this *elastic* activity, without it the informal vendor would have no place to appropriate. Additionally, this void has clear edges that fame it, making it possible to recognize the size, shape and location of the empty space. The edges represent the limit between used and unused space. Another important component is the adjacent flux or circulation space which is essential for the correct functioning of the city. The flux space is not affected by the presence of the cell phone vendor. In fact flux encourages the existence of the informal activity as the passerby becomes the costumer.

Figure 27 has been removed due to copyright restrictions. The information removed include a photo of an informal cell-phone vendor.

Figure 27. Image of "cell-phone man"

http://myephemerality.com/?p=276. Accessed: March 2010

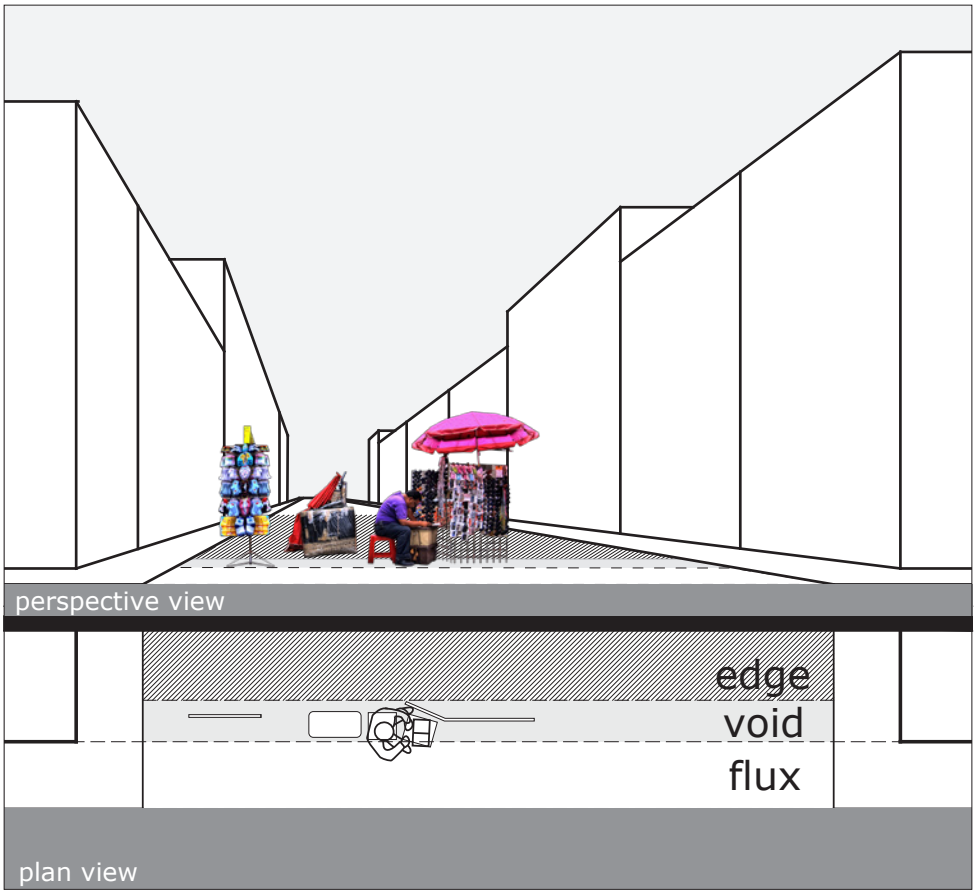


Figure 28. Zoom out and analysis of "cell-phone man" phenomena

This exploration and the identification of the three basic components of void, edge and flux unveils the rationale behind adaptable, spontaneous and informal phenomena. The analysis allows understanding of the individual function and qualities of each element while also evidencing the interdependence between them.

4.3 **Void, edge and flux**

From the observation of spontaneous events three main elements were extracted: void, edge and flux. This section provides a definition for these components in terms or Elasti-city. While the findings from the literature review provide very practical recommendations for adaptability, these are limited to the architectural scale and they speak of adaptability in terms of an end product while Elasti-city speaks of an open-en process. For this reason, this research finds that more abstract elements such as void, edge and flux can be easily applied to different scales and contexts.

Void. In the past, voids have been defined as "absence of construction" or the "left over" space between buildings (Gausa 655). In this sense, the shape, function and location of the void was determined by the built form, resulting in many cases in empty spaces without a purpose. In contrast, streets, squares and plazas are physical voids designed to provide a function, for this reason, this thesis doesn't consider these types of spaces as voids. This research defines *void* as any space without a function, neglected, abandoned or unused. Therefore, the void, by having an "unclear and undetermined status" offers the opportunity for informal and unplanned development to emerge (Corijn 503). Furthermore, the void becomes essential for cities to grow and respond to changes that are difficult to address through traditional urban planning methods.

The void, understood as an essential component for urban development becomes the object of design rather than undesigned space. Existing voids can be provided with new functions, both temporary and permanent while in new developments "projecting the void, its shape and its disposition" becomes imperative (Gausa 655). A common misconception from the" compact city" (Rogers) is the notion that, in order to achieve high-density, every void needs to be filled. However in terms of Elasti-city, voids should be given a function while allowing for the void to return to its original state of emptiness, permitting future transformations. Building the void would be removing elastic space from existence.

The void can take a different form and size depending on context and scale. Moreover, as seen in the Cell-phone Man case, the void can be temporary and can be relocated. The void in the urban scale can be an empty lot, a whole neighborhood that is underused, a building or a section of it. In both urban and the architectural scale, the void takes a similar meaning to "flex space", an area without a specific function but equipped with services to be "conquered" by the inhabitants (Gausa 656).

Edge. Is understood in this research as an element that delineates and frames space. While similar in meaning to *limit,* which speaks of separation, a clear delineation between one function and another, private and public space (Jacobs). In contrast, *edge* refers to demarcation while allowing for engagement. Basic dictionary definitions of edge describe it as "a line at which two surfaces meet" (Dictionary.com), this definition is more appropriate to a contemporary understanding of space as no longer limited to a specific area or function but engaged in a series of interactions with its surroundings. In this sense, the edge is no longer understood as an element of separation but as the link between events or functions (Gausa 334).

In Elasti-city, the edge becomes the transition between void and flux, a blurry space where each side engages with the other while being able to function individually. Moreover, a true elastic edge is able to move, mold and transform, allowing its adjacent spaces, the void and flux, to be reconfigured in location and form.

Flux. Is the space that allows people to move in, through and around cities and buildings. Flux space, by allowing "transfer" from one place to another can also be defined as an element of connection (Gausa 48). Moreover, flux is essential for cities to function, as stated by Lynch in *The Image of the City,* the mobile elements of a city are as important as the fixed parts (Lyinch 10). In contrast, lack of movement is understood as a state of chaos. Traffic jams, paralyzed transit lines, street repair or any action that prevents people from moving affect the correct performance of urban functions. For this reason flux, space such as streets, sidewalks, paths, corridors or hallways should be efficiently designed and be kept free of obstruction.

Flux can also be defined in two manners, permanent and variable. Cities and buildings have predetermined flux spaces that dictate how people move, such as streets, corridors or hallways. In contrast the built environment also contains paths that are traced by time according to people's desires to move in a certain manner, and these paths can be changed and modified in elastic ways. In this sense, flux also refers to a state of continuous transformation, where people's flow can transform the built form. Elasti-city understands *flux* as both the space for movement but also as a transformable element that can be redirected and by doing so affects the form, size and location of voids and edges.

Interdependence. After defining void, edge and flux, it is evident that more than independent these components are highly interdependent. While the void is determined by the edge, the flux permits the activation of the void by providing a connection to people and the urban fabric. A disconnected void is unlikely to be activated, while a void without a clear edge might not be understood as a space for appropriation. What is more, these three elements can constantly change in form, size, shape and location and as a consequence create dynamic urban environments.

4.4 **Conclusion**

This section sets out the methods of study to be used in Chapter 5. The complexity of urban environments and spontaneous phenomena challenge traditional forms of analysis. Discovering the rationale behind what is informal, unplanned and apparently chaotic requires the introduction of scientific methods into design disciplines. Furthermore if architects, urban designers and planners are able to acknowledge the benefits of informal urban development by understanding the order behind apparent chaos, then it is possible to design and plan cities that have structure but that allow for people to affect and transform urban environments.

This chapter also introduced key concepts for the study of adaptable environments, such as spontaneity, informality, chance, void, edge and flux. These concepts become essential for the analysis presented in the following sections of this thesis at the same time that they become components of the adaptable urban model of Elasti-city.

5. **Analysis**

Initial observations about spontaneous phenomena in Mexico evidenced the existence of a rationale behind what appears to be a random event. From this study three elements were identified, void, edge and flux which by interacting with each other generate the conditions that facilitate the elastic appropriation of a space. While these components were repeatedly observed on diverse phenomena in Mexico City, it is important to question whether these could be found in other contexts or urban scales. For this reason the following analysis explores a contrasting context, focusing on the city of Vancouver in Canada. In a sense, Mexico City and Vancouver represent opposites in terms of urban development, while one has grown with almost no regulation the other has been guided by a clear planning vision. This contrasting study allows an understanding of how adaptability and elasticity perform in different cultural, social, economic and political scenarios.

Figure 29. Change of context from Mexico to Vancouver.

Additionally, the analysis of Vancouver involves the study of diverse scales ranging from the city-wide overview to the small elastic interventions performed by individuals and communities. While the study of larger scales provides information about the regional factors that generate change, it also guides attention to the areas that are undergoing transformation and where elastic phenomena is located, something very useful when exploring an unfamiliar context. Comparatively, the study of smaller scale elements, a block, buildings or event, offers a detailed understanding of the manner in which the city adapts and transforms in direct response to large and small forces of change. Furthermore, the small scale studies provide useful tools that can be used to adapt existing buildings to new need as well as for new construction.

5.1 **City**

Vancouver. Vancouver is fairly young city on the west coast of Canada. The city is framed by a unique natural setting, surrounded by mountains and the ocean; it offers locals and visitors exceptional scenery and a wide range of outdoor activities throughout the year. It is no surprise that this west coast metropolis has been continuously rated as one of the places with the highest quality lifestyle (vancouver.ca) provided by a combination of natural elements as well as human efforts that have shaped the Vancouver of today.

The young city, which was only incorporated in 1886, has experienced fast growth doubling its population in less than forty years. Today, Vancouver is home to over 2 million people from diverse ethnic and cultural backgrounds

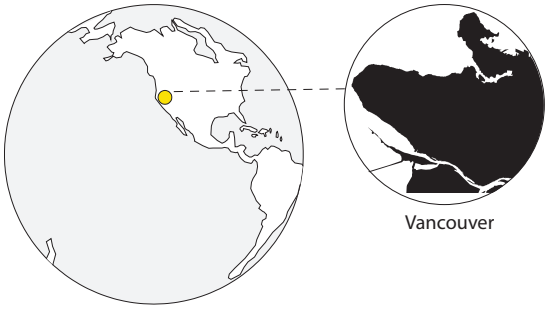


Figure 30. Location map of Vancouver.

(Brunet-Jailly, Vancouver: The Sustainable City 377). The city has been able to direct its growth though diverse planning strategies that have allowed the city to develop while searching to maintain a balance between the urban and natural environment.

Vancouverism. Vancouver has been shaped by key decisions made in its initial stages of development setting a solid ground to build a city considered an example for urban planners and designers around the globe. It is important to clarify that talking about Vancouver as a successful urban model refers mainly to the Downtown core, not the city as a whole or the metropolitan region known as Greater Vancouver Regional District. The city has been continuously ranked as one of the "most livable" cities in the world and now it looks forward to become the Greenest city in the world (vancouver.ca). Goals like these are the ones that have given direction to the urban development of the city.

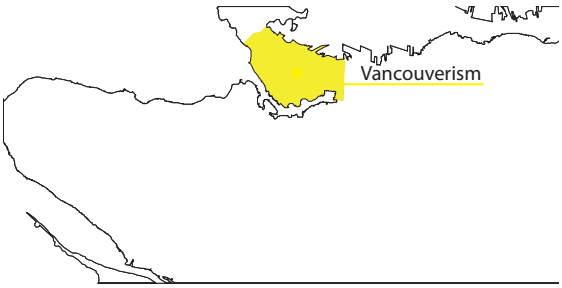


Figure 31. Vancouverism located mainly in the downtown core.

It is almost impossible to describe Vancouver without referring to its world famous planning model "Vancouverism". Vancouverism is nothing but a series of planning strategies that have shaped the Downtown core achieving high-density and mixed use communities with a good number of amenities served by transit, all of this in the proximity to the ocean or some other type of recreational open space (Owens 3). Most of the developments that exemplify Vancouverism are "mega projects" built on big blank land at the edge of the downtown area facing the water. The "mega project" strategy allowed planners to have more control and to design "complete communities", something harder to achieve when working with smaller scale or infill developments (Punter 266).

In a very simple way Vancouverism as a planning tool can be explained by the following strategies:

a) The planning department regulates the height of buildings and the density of the area; however this policy is

fairly flexible since heights and density have been increased as a trade off for the provision of amenities such as parks, plazas, community centers and non-market housing.

b) Mixed-use is achieved by generating very detailed zoning tools and guidelines that specify the types of uses allowed. The benefit of this strategy is that is forces at least some mix of uses, however it also restricts others.

c) Transit can be provided if an area is highly populated and most of that population is willing to use it. The city of Vancouver has fostered though diverse marketing campaigns, the provision of a fairly extensive network of buses, rail transit and bicycle routes.

d) Access to nature and recreational spaces was facilitated, firstly by place the natural setting of the city and secondly by planning tools that specify the size and location of open spaces.

e) Inclusion of the community in the planning process is achieved by consultation and public workshops. Although this strategy has very good intentions the reality is that political and economic factors tend to shadow the influence that people can have in planning decisions.

Vancouverism has not only generated a compact Downtown core with amenities but it has also focused on the protection of the natural environment and farmlands in close proximity. Moreover, Vancouverism has positioned the City of Vancouver as a world city attracting investment that allows the city to keep economically growing (Owens 6, 15).

Vancouverism conversely is not all about success; this model has also generated issues that have not been yet addressed. Higher densities have not been able to achieve affordability; in contrast, it has dramatically increased land value not only in the Downtown area but also in the whole city (Brunet-Jailly 383). Mid-income and low-income families are forced to move to neighboring municipalities where housing prices are lower, young professionals are able to live in the city with high cost accommodation that takes from 30 to 50% of their income and a homeless population continues to rise due to the replacement of affordable units with market ones. In this sense, Vancouverism is increasing social segregation and inequity. In addition, people who cannot afford to live close to their workplaces have to travel long distances, mostly by car. Traffic patterns show that people are commuting from neighboring municipalities towards the downtown core, while those who can afford to live in the City of Vancouver are commuting outwards to several industrial areas. Additionally, from the sustainable perspective, Vancouverism's famous podium-towers require large amounts of resources to be built while having high energy demands though their entire life. Many of these towers have not been designed to function efficiently or to be easily updated, consequently contributing to environmental degradation (Lee et al). Finally, the planning tools that created the predictable shape of Vancouver can be too restrictive preventing diversity in urban and architectural styles which are essential components of diverse and dynamic cities (Boddy 15).

Vancouverism has been successful in certain aspects and problematic in others, therefore it is important to take lessons learned from a model that has to some extent revolutionized urban planning but it is also essential to move beyond and develop alternative strategies that are adequate for the current social, cultural, economic and environmental situation. If the city continues to grow through a process of the copy-paste of Vancouverism, it will not move forward and it will certainly not keep its status as a livable and desirable city to live in.

Growth and Future. Vancouver continues to grow; the city is expected to add 30,000 people in the next 25 years, requiring alternative urban models to accommodate such population in a sustainable and livable manner (EcoDensity 13). In recent years development concentrated in the Downtown peninsula, which has nearly reached its maximum capacity, moreover as many activities continue to be centralized, Vancouver's downtown is expanding into adjacent neighborhoods and arterial roads that are rapidly increasing their density. In addition there is an evident lack of local-focus planning for these areas of expansion, allowing generic developments. In many cases, urban strategies and building forms related to Vancouverism are being replicated in areas that may not require this type of development, moreover the de-contextualization of such a model is increasing land value, promoting speculation, as well as replacing vibrant urban scenarios and communities with sterile ones.

Figure 32. Vancouver is growing extending density of downtown towards neighboring areas.

As development is rapidly spreading to neighborhoods such as Strathcona and Mount Pleasant, there is a need to generate design and planning tools that allow the city to grow while responding to the conditions and needs of these areas which are growing regardless of the existence of adequate urban plans. New urban plans take a long time to be developed. Therefore, areas either grow without guidelines or don't grow until a plan comes in place. As a consequence, many historic areas and residential neighborhoods are torn down, big towers are built in the middle of nowhere or big expanses of land are kept undeveloped, increasing their value in areas that should be the first one to be densified. In addition, Vancouver has a growing tendency to develop large portions of land in a short time. Many blocks with individual lots are transformed into one building-block by one big developer; this type of developments may achieve high density by providing minuscule spaces in which to live detached from the ground, the street and other people. All of the issues mentioned expose the need to generate alternative plans and the processes behind them in order to increase efficiency and the degree of adaptability or urban tools and strategies.

Currently Vancouver is exploring a new model called EcoDensity which will allow the city to find alternative and more sustainable forms of density while exploring strategies of infill and urban renewal. This model is intended to be complemented by other strategies, and whether these are old or new ones, it could potentially allow for a wider diversity of urban strategies and developments (EcoDensity 3). However, EcoDensity still strands as a fairly vague model that hasn't provided specific guidelines for each area of development.

Change per area = elasticity. The city of Vancouver is changing fast, growth and developments are sprouting up throughout the city, especially in certain areas that can be easily transformed due to a relaxed regulation and lack of heritage designation. Moreover, change is happening in a dispersed manner, therefore identifying a neighbourhood of focus required a more detailed study to locate the area of the city undergoing most change. Additionally, as this analysis aims to be as scientific as possible, the selection of a focus area should also reflect the use of sci-

entific methods rather than be random.

As defined before, Elasti-city is closely related to change and the manner in which cities, neighbourhoods and buildings transform and adapt. Therefore, it seemed natural to locate *change* assuming that that this would lead to the identification of an area where elastic phenomenon could be situated and studied. Using data from the Planning Department of the City of Vancouver, it was possible to map different types of change such as rezoning, change of use, development, construction, alterations or change of policy. All of these changes are evidence of transformation. The data provided by the City of Vancouver provides detailed information of each project, providing a clear idea of the stage of development the area is at, whether it is just a change in policy that will later lead to major construction or if new buildings have already started to appear or if modification only includes alteration to existing structures (P. D. City of Vancouver).

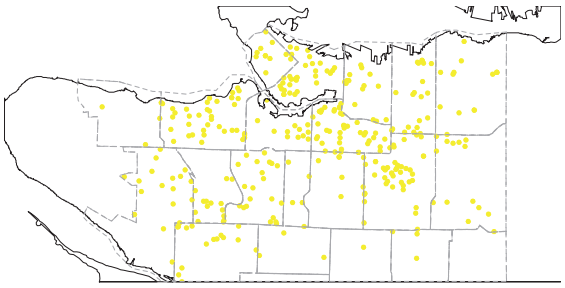


Figure 33. Mapping types of change and neighborhood subdivision.

Data extracted from: City of Vancouver. "VanMap." 2010. Permit Board Data. City of Vancouver Community Services Planning Department. May 2010. <http://vanmappub.vancouver.ca/cwp/vanmappub.cfm?frmCommunityID=0&frmTypeID=5&frmDeptID=1&frmNewWindow=1>.

Once the data was located on the map, the division of the city into neighbourhoods was taken into account. This was done with the purpose of selecting an area of study that was located in a single neighbourhood and not amid two or three. Studying one locality simplifies access to information and data which is usually divided by neighbourhood. Additionally, to measure change per neighbourhood a simple formula calculated the *number of changes per area,* this allowed locating the neighbourhood with highest number of transformations. Mount Pleasant is one of the neighbourhoods with a major number of changes per area at the same time that it is an interesting area of study due to its diversity in terms of use and its location in proximity to the Downtown Core.

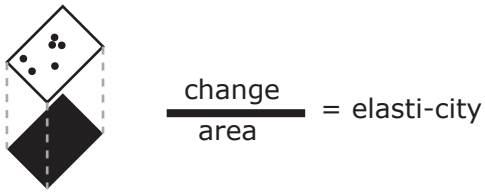


Figure 34. Fomula to find elasticity.

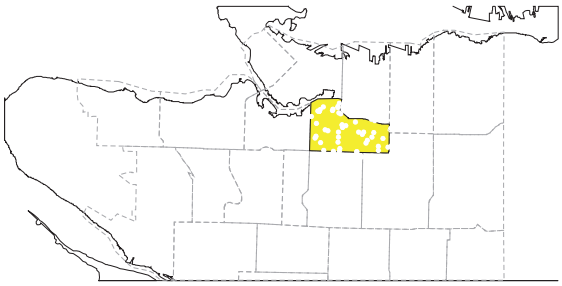


Figure 35. Mount Pleasant the neighborhood with more change per area.

The location of change in Mount Pleasant can be explained in terms of Elasti-city. As Vancouver's downtown increased its density it has nearly run out of available land for future growth, resulting in the expansion towards adjacent neighbourhoods. Moreover the downtown area has defined *edges,* Stanley Park limits the area towards the West while the water edge borders the North and South sides. These natural *edges* direct growth towards the East and South-East, pressuring two neighbourhoods to allocate new development, Strathcona and Mount Pleasant. These two areas can be considered *voids* at the city scale, underused areas where transformation can take place. However Stratchona can't transform as dramatically as Mount Pleasant since it is a neighbourhood with heritage designation while Mount Pleasant contains a great amount of empty land in its industrial area and at the waters edge by False Creek. The following section studies this neighbourhood while looking to identify elastic and adaptable phenomenon.

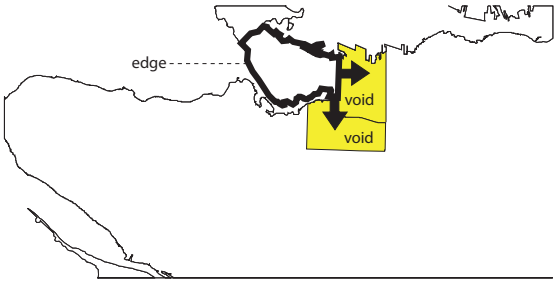


Figure 36. Edges and voids at the city scale.

5.2 **Neighbourhood**

Mount Pleasant. This neighborhood is located at the South-East of Vancouver's downtown and is connected to it by Main Street one of the city's arterial roads that acts as a main urban connector in the North-South direction. The proximity to the business core allowed the area to develop early into an active and mixed industrial and residential neighborhood, which had a street car terminal, a train station and Vancouver's first high rise, the Lee Building. However later decisions such as the introduction of railway yards disconnected the neighborhood from the important natural feature of False Creek and allowing industrial uses to take over residential ones especially in the polygon to the north of Broadway and between Cambie and Main Street (City of Vancouver, Community Web Pages- Mount Pleasant).

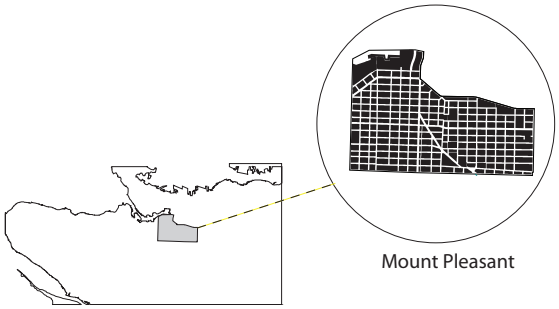


Figure 37. Location map of Mount Pleasant.

Today Mount Pleasant is an attractive area for development due to its location and land availability. Moreover, change in use and production models are rapidly transforming the industrial segment of the neighborhood. This industrial area is easy to renew and repurpose given that the buildings in it have flexible structures and don't contain heritage designation while lots are large and land value is lower. In addition, the neighborhood is well served by transit and at the same time provides a wide variety of services, retail and food. Moreover, Mount Pleasant has become one of Vancouver's most vibrant communities where many artists and young creative people live. All of these factors call attention to this neighborhood which is rapidly transforming.

New buildings are sprouting up throughout the neighborhood following planning intentions of increasing the density in the City, however new development in the area tends to neglect the local conditions that provide identity to Mount Pleasant. Hence it is extremely important to understand the social, cultural, economic and historic context of Mount Pleasant in order to allow growth without wiping out the character of the neighborhood that results less from buildings than from the people that live in it. The current problematic relies on finding a manner of bringing higher densities without duplicating models adequate for the Downtown peninsula. The development of Mount Pleasant should provide planning and design solutions that respect the existing qualities of the neighborhood, protect existing activities and buildings while avoiding the displacement of the current population.

Population. According the latest Census Data 23,615 people live in Mount Pleasant representing 4.09% of Vancouver's total population. The neighborhood spans 364 hectares, a similar figure to the 375 hectares encompassed by Downtown that in the same area contains 43,415 people, almost double of the population of Mount Pleasant (Statistics Canada). This comparative data shows that Mount Pleasant, regardless of the proximity to the Core, remains almost suburban, where low density housing typologies, such as detached and semidetached single family housing and duplexes dominate the urban environment. Additionally, a big portion of the neighborhood is designated as industrial land, which allocates many jobs, but also reduces the space available to introduce high-density residential typologies.

According to reports from the City of Vancouver Community Planning, the population of Mount Pleasant has decreased 3.4% while Vancouver's overall population has grown 12.5% (City of Vancouver). This could be a reflection of the household composition that shows a decrease of 2.0 people per household in 1996 to 1.8 in 2006 (Statistics Canada). Nevertheless these figures might change with new developments such as the Olympic Village which will be home to 16,000 people adding 1,110 new units directed to families and low income people (vancouver.ca).New developments in the neighborhood show that Mount Pleasant could provide an alternative for growth in proximity

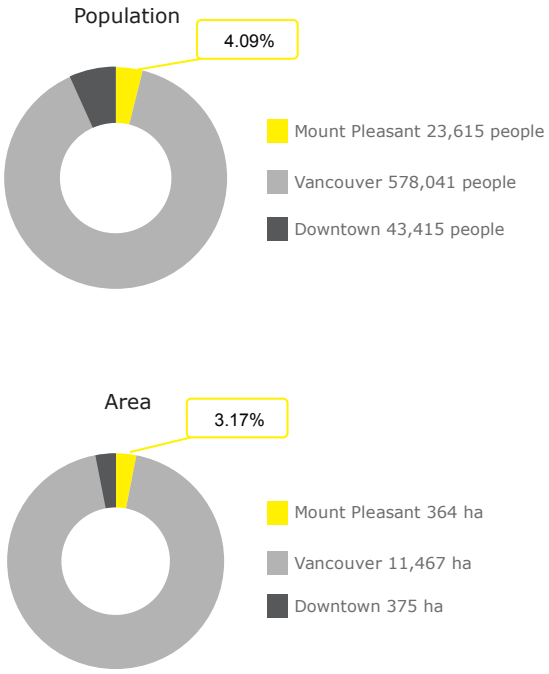


Figure 38. Comparative population data.

Data extracted from: City of Vancouver. "Community Statistics." 2006. Census Data. City of Vancouver Community Web Pages. July 2010. < http://vancouver.ca/commsvcs/planning/census/2006/localareas/mtpleasant.pdf>.

to Downtown. The challenge relies on transforming a former suburb with well-consolidated residential areas into a more intense urban environment. Undeniably this will lead to the revaluation of Mount Pleasant industrial areas and the possibility to mix existing uses with new residential and commercial ones that will satisfy the needs of an increasing population.

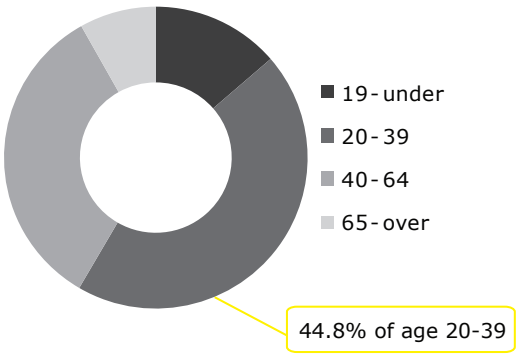


Figure 39. Population and area of Mount Pleasant.

Data extracted from: City of Vancouver. "Community Statistics." 2006. Census Data. City of Vancouver Community Web Pages. July 2010. < http://vancouver.ca/commsvcs/planning/census/2006/localareas/mtpleasant.pdf>.

Looking at the different age sectors of Mount Pleasant population allows an understanding of not only how many people but what type of people live in the neighborhood. Mount Pleasant has two clear dominant groups in its population, people from 20-39 years old represent 44.8% and from 40-64 33.8% while seniors and children show significantly lower figures. Moreover the neighborhood is shown to have more people between 20 and 39 years old than Downtown and it is also above the average of Vancouver (Statistics Canada).

Mount Pleasant is known for the young and creative people that live and work in the neighborhood which can be correlated to the Census Data. This presence of people in the early twenties to late thirties is also evident in the type of cultural, recreational and commercial activities in the neighborhood which create a vibrant and diverse urban environment.

Density. Density refers to the "population occupying a given area of land" and it is commonly expressed in terms of people per square kilometer (Mozas 14). Areas with higher densities support a wide array of commercial activities, services such as schools, libraries and community centers, a well served transit system, allowing people to satisfy if not all then most of their basic needs without leaving the neighborhood and therefore living in more sustainable ways. High density can also generate vibrant communities if building typologies and urban scenario allow for it. However high-density when badly done can result in sterile urban environments where people regardless of the proximity to each other live isolated in their apartments. Therefore, it is important to create buildings and urban spaces that increase density while potentiating the social connections of a neighborhood.

The density of Mount Pleasant is 6,487 people per square kilometer which is well above Vancouver's average of 5,040 people per square kilometer. In comparison to Downtown's density of 11,577 people per square kilometer (Statistics Canada), Mount Pleasant can be considered to be a medium density neighborhood with enough people living in it to support a diversity of services, commercial establishments and transit lines. Nevertheless, it is remarkable that downtown almost doubles the density of Mount Pleasant in roughly the same area. This is achieved by the construction of high density and mixed use high-rises that expand though the Core, however these building typologies are not adequate for semi-suburban neighborhoods such as Mount Pleasant.

Population/Area = Density

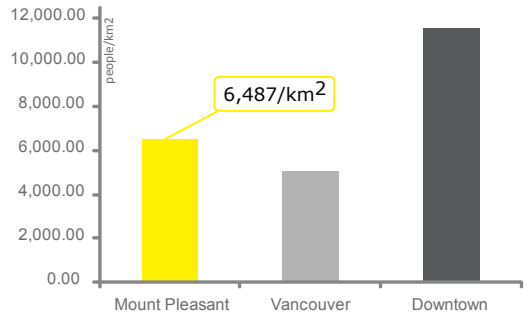


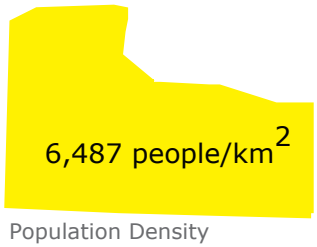
Figure 40. Comparative density graph.

Data extracted from: City of Vancouver. "Community Statistics." 2006. Census Data. City of Vancouver Community Web Pages. July 2010. < http://vancouver.ca/commsvcs/planning/census/2006/localareas/mtpleasant.pdf>.

In order to provide adequate building typologies and urban strategies to increase density it is important to identify the areas that allow for it while protecting existing residential sections that have a well established population in the neighborhood. For this reason this research correlates two types of densities, residential and employment, which facilitate identifying where people live and work. Additionally the study of density is correlated to the area's land use, block and building typologies.

Population Density refers to the number of people living in a square kilometer while employment density refers to the number of jobs per square kilometer. Overlaying graphics showing the highest residential and employment densities (Figure 41) shows opposite patterns, where higher residential density is located there is lower employment density and vice versa.

This separation of work and live is evidence of a lack of mixed-use. In residential areas it is harder to incorporate other uses due to building typologies, heritage designations and fear among home owners of the disruption of their quiet and peaceful environment. In contrast, Mount Pleasant's industrial area and commercial corridors such as Broadway, Main and Kingsway could allow for a wider diversity of activities, moreover transformation of existing industrial and commercial buildings is easier. Furthermore these industrial and commercial areas are highly underused and contain numerous vacant buildings and empty parking lots; all of these spaces offer opportunities to increase residential and employment density in the neighborhood.



Population Density


Population Density

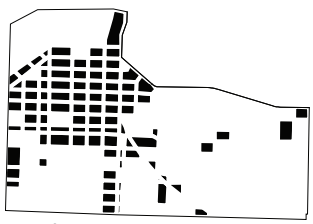

Employment Density

Figure 41. Graphic of residential and employment density.

Finally it is important to think of density not only in terms of quantity but also in terms of the quality of buildings and urban spaces people will live in.

Population density. Population density shows the concentration of human inhabitation in the city. In the case of Mount Pleasant it is evident that the areas with higher density are located in proximity to major corridors such as Broadway, Main and Kingsway and Great Northern Way. This shows a clear planning strategy, where higher densities and taller buildings are permitted along the corridors which literally generates a barrier that separates single family housing from these high volume roads. Therefore high densities generate a perimeter and lower densities are located inside it making them more adequate for families with children.

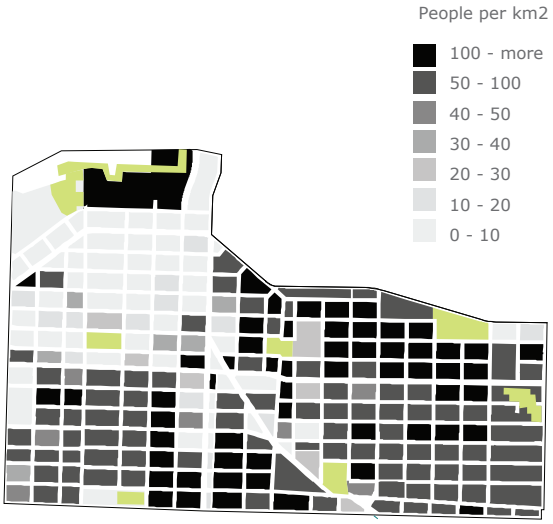


Figure 42. Population density map.

Data extracted from: City of Vancouver. "2006 Population Density City of Vancouver" 2006. Online Image. City of Vancouver. July 2010. <http://vancouver.ca/commsvcs/planning/census/2006/popdensity.pdf>.

A major change in the density of the neighborhood has been brought about by the construction of the Olympic Village. This development will bring enough people into the area to sustain new commercial activities, services and recreational spaces. In addition new development is rapidly spreading throughout this area and will dramatically transform part of the underused industrial area. These higher densities are also starting to move towards the active industrial area, threatening to take over existing uses that generate many jobs. Moreover, if developments take over industrial lands they could mix residential uses with compatible light industrial or commercial activities and therefore generate more diverse communities.

As the area continues to grow and increase its density, it is important to work with the existing conditions and respond to the context. A way of doing this is by learning from existing block and building typologies which can serve as a guide for new developments in terms of built form, type of open space needed and uses that are compatible with the current conditions. It is essential to understand that Mount Pleasant is not an extension of Downtown

but an area with its own cultural, social and natural characteristics and as a consequence a neighborhood with its own type of density.

A way of exploring adequate typologies for higher densities can be done by correlating data about residential density and residential land use. It is important to note that this analysis is done at the block scale giving some information about the building scale but building typologies are not explored in detail at this point. The correlation evidences that high density blocks correspond to ones with a majority of apartment buildings, medium density to multi-family dwellings such as duplexes and low density to single family detached houses. Another category is the hybrid residential block; this refers to blocks with a mix of residential, commercial and industrial buildings, a mixed-use block. Although in Mount Pleasant it is common to find mixed blocks it is rare to come across mixed building typologies, which are just starting to appear in the neighborhood.

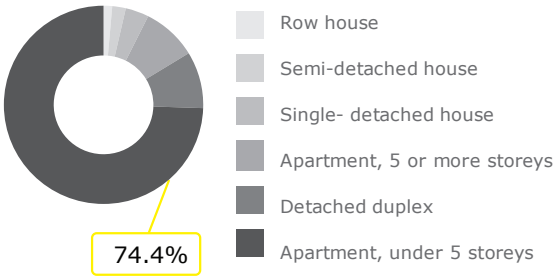


Figure 43 Correlation density and building typologies.

Data extracted from: City of Vancouver. "Community Statistics." 2006. Census Data. City of Vancouver Community Web Pages. July 2010. < http://vancouver.ca/commsvcs/planning/census/2006/localareas/mtpleasant.pdf>.

If high-density is to be pursued in the neighborhood it is very clear that it shouldn't come in the form of Downtown's podium-towers, since Mount Pleasant contains a whole different range of qualities and needs. According to existing Census Data, the dominant building typologies in Mount Pleasant are buildings under 5 stories (Statistics Canada), in contrast, new developments in the Olympic Village area allow for higher buildings up to 24 stories. New construction must be carefully regulated so higher building forms appear in spaces that are adequate and without affecting views or sun exposure. Moreover it is important to recognize that higher density is not only achieved by high buildings. Other neighborhoods in Vancouver such as Kitsilano and the West End have achieved very high densities mostly with mid-rise buildings between 3 and 5 stories. These typologies are not only cheaper to build, but also have a lower environmental impact and allow for more social interactions between its inhabitants (Lee et al 3-5).

A closer look at blocks with low, medium and high densities shows the different building typologies that exist in the neighborhood. This also evidences the time in which each typology was built. Low density blocks contain many heritage houses that have been frequently converted into duplexes to make them more affordable and as a consequence increase density. Medium density blocks contain several mid-rises from 3 to 5 levels built throughout the 20th century. These buildings are the ones that bring most of Mount Pleasant's density. High density blocks

contain higher mixed-use buildings which correspond to recent building technology and techniques characteristic of contemporary developments. It is interesting to look at these three building types since they generate different block configurations. For instance, lower density buildings, such as single family houses, require smaller lots and therefore allow for more land owners per block than mid-rises that occupy several lots per building or high-rises that take over an entire block. In terms of greenery, the higher the density the less open and green space is provided, high-rises often provide elevated patios that in theory belong to the building's large community but tend to be underused and don't provide a facility to the general public. These are just a few of many aspects to consider when thinking about density in a qualitative manner rather than in a quantitative one.

Finally, it is a fact that Mount Pleasant contains some consolidated residential areas, however, it also has plenty of underused industrial lands and density in the corridors that have not been totally explored. Therefore, this neighborhood offers an opportunity for growth without erasing the existing urban structure. Additionally, industrial lands offer larger lots that are very attractive to developers who therefore don't have to be buying off individual land owners. On the other hand, it is central to value the character of the industrial area, because most of the existing industrial buildings are not designated as heritage they are an easy target to be bulldozed and replaced by generic developments.

Employment density. Mount Pleasant is considered to have a medium-high employment density. Nevertheless figures taken from the Metropolitan Core Jobs and Economy Land Use Plan show that only 7,100 people work in the neighborhood, which is not a very high number in relation to the 312,700 jobs in the City of Vancouver (City of Vancouver). This data indicates that there are opportunities to increase employment density in the neighborhood, especially in the industrial areas and the major arterial roads. Observations on the industrial areas of Mount Pleasant confirm that the area in highly underused, this is demonstrated by the numerous vacancy signs, empty parking lots, and the inefficient use of land where small buildings are located into large lots providing yards that are no longer required for most of the activities in the area.

In comparison, explorations on residential density show that areas for potential higher residential and employment density overlap directing developments towards the exploration of mixed-uses. This implies a deep study

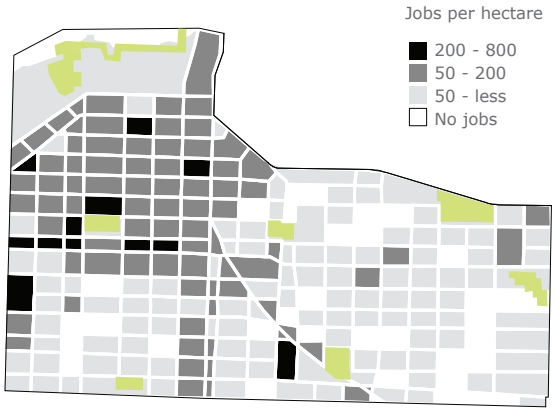
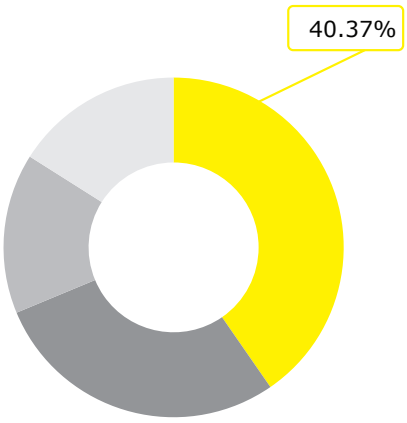


Figure 44. Employment density map

Data extracted from: City of Vancouver. "City of Vancouver's Employment Density in 2006." 2006. Online Image. City of Vancouver. July 2010. <http://vancouver.ca/commsvcs/planning/stats/diversityjobs/index.htm>.

of the existing activities that generate such employment and their compatibility with residential and commercial uses. Moreover, compatibility studies should consider the factor of time. It is a fact that not all the activities happen at the same time and they do not occupy the 24 hours of the day, therefore uses that take place in the morning don't get in the way of ones that take place later on during the day. For instances, many auto shops in the area function in a normal schedule from nine in the morning to five in the afternoon, after this time they close their doors leaving space for other activities such as commercial or recreational to take over. In addition, residential uses are not as active at all times, most people leave home to go to work during the day and then come back to their homes at the same time offices and industrial uses are closing their doors. These are observations that can change the manner in which planners and urban designers envision mixed-use developments.

In Mount Pleasant this mix of uses should sustain current activities divided into four sectors: manufacturing, finance and insurance, wholesale, information and culture. Manufacturing is the dominant sector providing 40.37% of the jobs in the neighborhood; in addition this sector is the one that would be the least compatible with residential uses. However all the other sectors together compose 59.63% of the jobs and are compatible with a wider diversity of activities (City of Vancouver). Currently the area shows mixed blocks where industrial, commercial, office and residential buildings exist next to each other. Denying the possibility of bringing new uses into the industrial area would be to deny a condition that already exists while embracing such a rich diversity can result in more interesting and functional buildings, blocks and neighborhoods.



Sectors	Sub-sectors	Num. Jobs	Total Sector
Manufacturing	Clothing manufacturing	910	1310
	Printing	300	
	Fabricated metal product manufacturing	100	
Finance and Insurance	Banking	555	920
	Stock brokerage	365	
Wholesale	Machinery wholesale	200	495
	Personal goods wholesale	180	
	Food & beverage wholesale	115	
Information and Culture	Motion picture and video	365	520
	Radio and television broadcasting	155	

Figure 45. Sector and sub-sectors of employment in Mount Pleasant

Source: City of Vancouver. "Mount Pleasant Industrial Area Today." Planning Report. City of Vancouver, 2005

Besides reframing the definition of the industrial zone, the corridors that cross through Mount Pleasant also offer great opportunities. Many of the buildings framing corridors of Broadway, Main, Kingsway and Great Northern Way are just a few stories high and often contain only one use on the ground floor, having vacant upper levels. Moreover it is in corridors where higher buildings could be beneficial in terms of residential and employment density at the same time that these building forms could help to frame the urban landscape and generate better streets.

In short, Mount Pleasant involves the creation of models that combine residential and employment density done though an exploration of use compatibility.

Land use and zoning. Mount Pleasant hosts a wide variety of activities that are somewhat organized corresponding to zoning regulations. Zoning is a tool that determines the uses allowed in a certain area. This planning tool provides very general data and does not provide information at the block or lot scale. In contrast, land use plans provide more detailed information by mapping the type of activity per block or lot. However land use maps are difficult to keep up to date with activities continuously changing. For this reason, the best manner of studying the type of use in an area is done though a combination of both, zoning and land use. In addition, site visits and observations allow verification of the information provided by the Planning Department of the City of Vancouver.

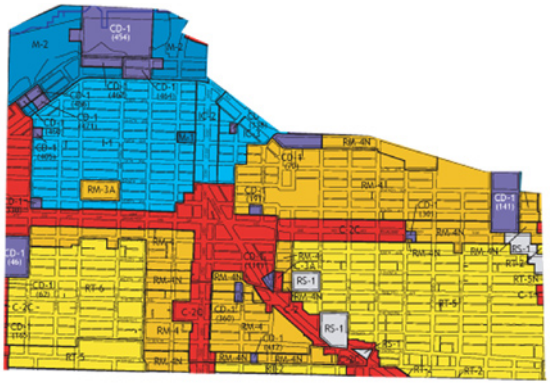


Figure 46. Mount Pleasant's zoning map.

Source: City of Vancouver. "Coloured Zoning Map." 16 July 2009. Online Image. City of Vancouver Community Services. August 2010. < http://vancouver.ca/commsvcs/currentplanning/coloured_zoning_map.pdf>.

The zoning map shows very distinct areas designated to different types of uses. Although Mount Pleasant is mostly a residential neighborhood it contains a fairly large industrial area located towards its North edge adjacent to the new Olympic Village development. In addition, the neighborhood's corridors are zoned to allow a mix of commercial and residential activities. In general terms, the zoning plan shows a clear intention to protect the residential areas from the high traffic on the corridors and the industrial area which is surrounded by high traffic arterials allowing easy transport of good and products. The commercial strips act as the mediator between residential and industrial uses. The zoning map also evidences certain areas of conflict where uses that are not compatible are located next to each other; this is also evident while walking in the area. Although a mix of uses is desirable, it is important to study the compatibility of activities. Moreover, certain building typologies can allow for a greater mix of uses, an example of this can be found in new developments located on Cambie and Broadway where large scale retail is located at the bottom with residential on top, this type of building starts to show the possibilities of mixing uses.

While studying the neighborhood it is important to correlate information from zoning and land use maps that together provide a more accurate reading of the area. A zoning map shows, for the most part, the current uses allowed in a certain site, however, the existing uses show a greater diversity than the one encompassed on a zoning map. Land Use data for this thesis was extracted from the land use map by the City of Vancouver generated in

2001 (City of Vancouver); therefore, it may show some contradictions in some areas that have changed since that date. Nevertheless, the information provided by block helps to understand the neighborhood with greater detail. Initially the land use plan provides detailed information about the activities of the area by lot although this information proved to be too detailed for the study at the neighborhood scale. For this reason the information by lot was synthesized and grouped into other categories that allowed reading the data by block rather than by lot. The categories proposed for this synthesis are:

- Commercial-Industrial-Residential
- Industrial-Residential
- Commercial-Industrial
- Commercial-Residential
- Cultural-Recreational-Service
- Residential
- Industrial
- Commercial
- School

These (Figure 47) categories allowed the formulation of an overview of the activities in the neighborhood and the location of such uses. Moreover, this categorization can also be read as two main groups, hybrid block and single-use blocks. Figure 48 maps both hybrid and single use blocks at the same time that it allows distinguishing certain

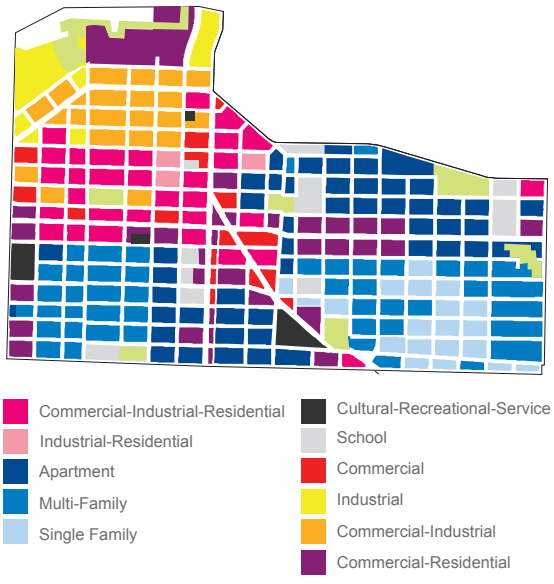


Figure 47. Land use categories used for this thesis.

Land use data extracted from: City of Vancouver. "City of Vancouver Land Use 2001." 2001. Online Image. Understanding Vancouver. August 2010. <http://vancouver.ca/commsvcs/planning/stats/landuse/index.htm>

patterns in the neighborhood. The first and clearest pattern is the geographical separation between single and hybrid blocks.

Single-use blocks contain mostly residential uses and tend to be offset from the corridors and protected by commercial and commercial-residential blocks. Industrial blocks are grouped on the north-west side of the neighborhood, an area zoned as industrial, which prevents many uses to be allocated in this sector. Finally, commercial blocks are almost exclusively located along the corridors. In terms of hybrid blocks, these are located along the corridors and on the industrial zone. The hybrid nature of the industrial area is related to the history of the neighborhood and the changes it has gone through over time, in a way diversity of use is a trace of history or a process of hybridization.

After analyzing both the zoning and land use data it becomes evident that although the area contains a diversity of activities these tend to be segregated while having some areas of collision where the different uses are not engaged with each other in a productive manner. These zones of collision represent edges with an undefined character or function, however, these are the ones where it is worth working since they have the potential to become diverse zones where unique typologies emerge out of apparent incompatibility mediated by adequate architectural typologies.

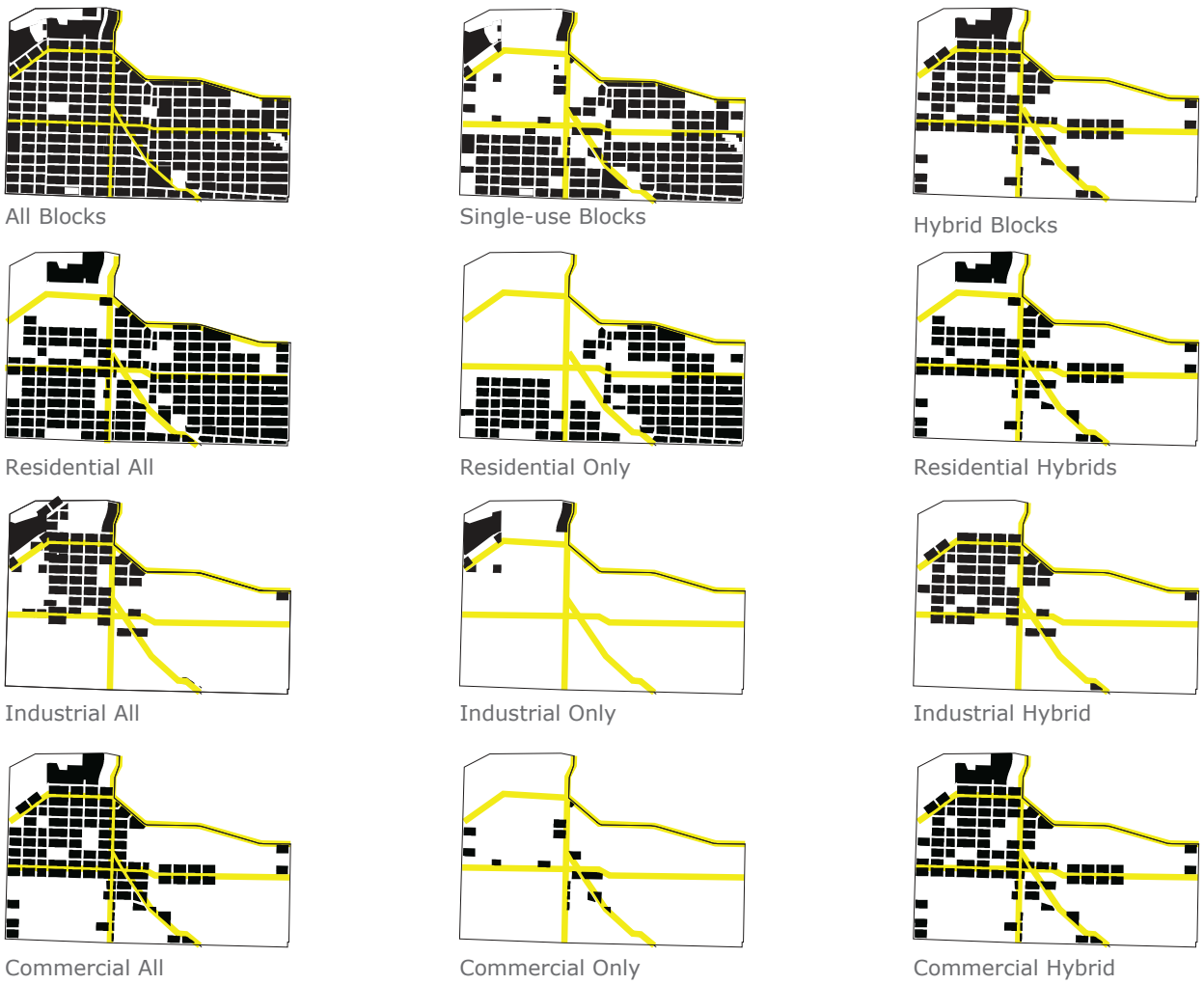


Figure 48. Hybrid and single use blocks

Connections. It is important to briefly note that the neighborhood is well connected to the rest of the city by main corridors such as Main Street, Kingsway, Second Avenue-Great Northern Way, Broadway, Cambie and Clark Drive which are some of the main connectors not only for this neighborhood but for the entire city. In that sense Mount Pleasant is a neighborhood with great potential given its centric location and proximity to downtown Vancouver.

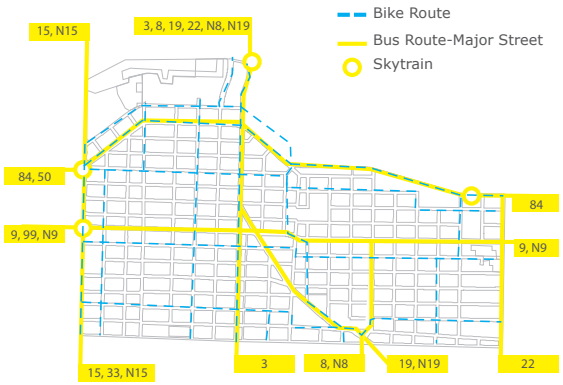


Figure 49. Transit lines and major routes on Mount Pleasant.

Transit data extracted from: Google. 2010. Online Image. Google Maps. August 2010. <http://maps.google.ca/>

In term of transit, the area is well served though major transit lines that run almost exclusively along the corridors. The inner areas framed by the corridors, while in proximity to transit, still provide a quiet environment for families that live in the residential zones of the neighborhood. Additionally, the neighborhood contains a wide network of bicycle routes that are taken away from the main arterial and located on the inner streets which are safer for cyclists.

In general terms it is fair to say that Mount Pleasant has a good offering of transportation options, however, the frequency and availability of transit can be limited in certain points of the neighborhood. While the area continues to develop and higher densities are brought in, it will be possible to provide a wider and more efficient transit network.

Summary. The study of Mount Pleasant evidences the potentials of the area in terms of its location, diversity of activities and character. An outstanding quality is the hybrid nature of the neighborhood which results from the accumulation of layers of history. In this sense Mount Pleasant is truly a neighborhood that results from an accumulative process of city building though time. This hybrid nature signifies great potential to mix new uses with existing ones while allowing higher densities to be brought in and potentially generate a vibrant and dynamic urban life.

The analysis provides clear direction of the location regarding potential new developments, which would naturally be located towards the corridors and industrial zones. Locating new development in these two areas allows protection of the consolidated residential areas while bringing life to the corridors, which in terms of activity are highly underused. In this manner, one can argue that Mount Pleasant, in terms of land use, is divided in two zones,

a well established residential zone with many heritage buildings and a vulnerable and underused commercial-industrial area. What is more, documents from the Planning Department of the City of Vancouver (Planning) show that these observations have already being identified and the response in terms of planning has been to create a distinction between areas to protect, and areas to transform.

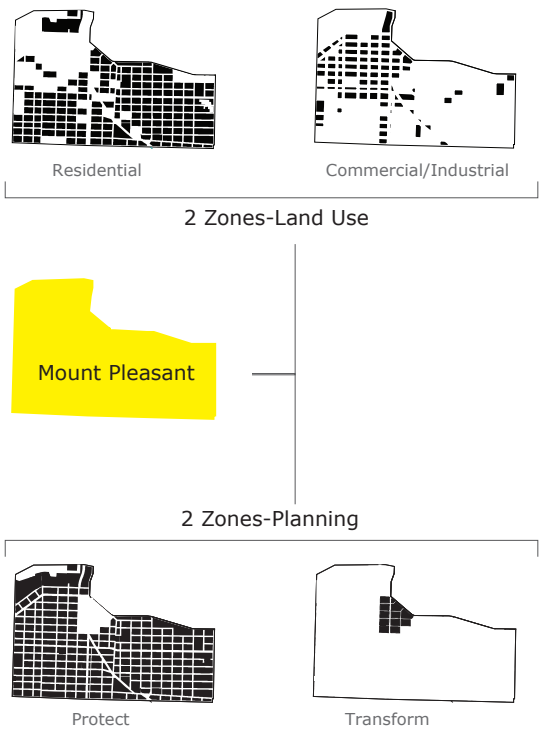


Figure 50. Summary diagram

The areas to protect include the residential zones, and the industrial section of the neighborhood located south of False Creek. If the industrial area was opened for development it would possibly result in the displacement of jobs and industrial functions. Protecting industry within the city is essential to achieve a more sustainable and compact urban model where people don't need to commute great distances to go to work. Moreover, the industrial buildings in the neighborhood are a scarce resource for small companies and artists in the city, therefore taking these spaces away could potentially result in the gentrification of the creative industry that has been established in Mount Pleasant. For this reason it can be argued that the Planning Department has taken adequate approaches to channel development towards the corridors and to a polygon framed on the west by Quebec Street, the east by Brunswick Street, the north by Second Avenue and the south by Seventh Avenue. This polygon is the site to be studied in the following section of this chapter. It is in and around this polygon that large scale developments have started to appear, but unfortunately erasing the existing urban fabric, tearing down buildings and displacing uses that may seem irrelevant but are key components of the identity of the neighborhood.

5.3 **Site**

This next scale of the analysis is focused on a polygon that has been identified by this research as a zone adequate for new development, in parallel, the Planning Department of the City of Vancouver has also recognized the potential that this area offers for Vancouver's future growth. The site is an area where many forces collide lacking of mediation between diverse land uses and urban structure resulting in a fragmented zone. A walk through the site evidences this disconnection and the lack of design strategies to integrate this fragmented area. At the moment, the polygon is strongly divided in 3 distinct zones, each one representative of the activities that surround it, industrial on the west, artist live-work on the north-east, and residential on the south-east. As these three zones collide without integration it also suggests that the site has been neglected from previous urban plans. However documents from the Planning Department of the City of Vancouver state that planning instruments are being generated for this area and will be implemented in the coming years (City of Vancouver).

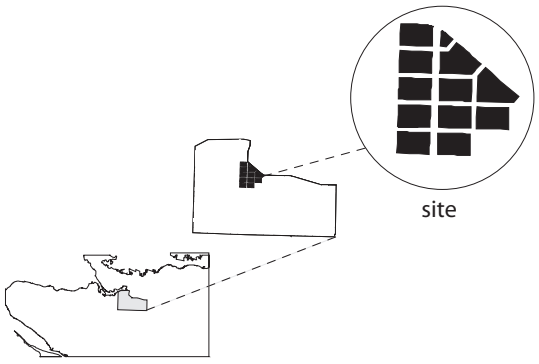


Figure 51. Location map of the site of study.

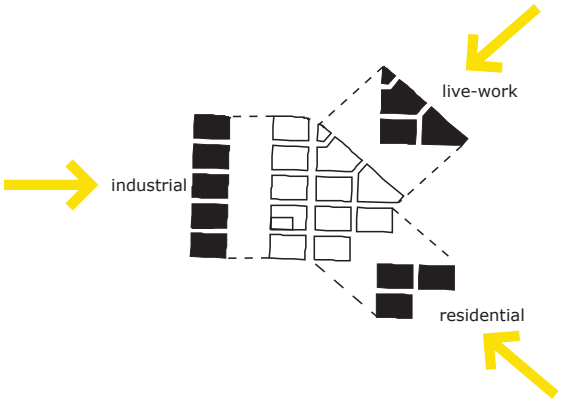


Figure 52. Forces that collide on the site.

While walking through the site, the amount of available land for development became evident, this was confirmed by analyzing the urban fabric on a figure ground drawing which showed a low concentration of construction in relation to void spaces. Moreover, it is remarkable that the site remained almost untouched and undeveloped until recent years while containing many empty lots and vacant buildings that are easy targets for development. While the site is in proximity to a more vibrant section of Mount Pleasant located along Main Street it still feels empty, deserted and vacant. This feeling of *emptiness* also reflects a car-oriented environment that is hostile for pedes-

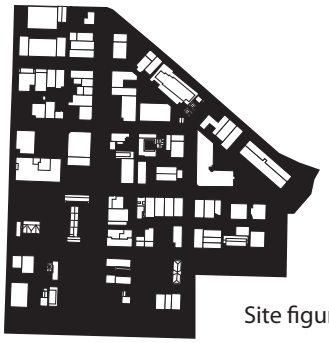


Figure 53. Figure ground showing felling of "emptiness" of the site

trian movement. Furthermore, the scale of existing industrial buildings generates an uninviting environment, while some of the uses on the site discourage the introduction of activities attractive for pedestrians such as retail, food, entertainment and recreational spaces. While the site conditions imply great challenges in terms of integration of existing buildings and activities into new developments, it also provides great opportunities. The introduction of adequate buildings typologies could allow for the integration of small scale industry with residential and commercial uses while increasing density and intensity of activity on the site.

As the City of Vancouver continues to grow, large scale developments have started to appear on the site allowing to increase density and to introduce new activities. However, the value of the existing conditions of the site has been generally neglected. As a rule, every time a new building comes in place it entails the demolition of existing industrial buildings and displacement of existing uses and inhabitants. For this reason, there is a need for alternative development models that respond to the context by engaging with the site conditions rather than ignoring them. It is important to remember this industrial area is an important source of employment for the City of Vancouver, which is why it is essential to ensure its permanence. Moreover, preserving the existing functions implies getting to know the operating modes of such activities. One of the most evident examples of operating modes that are specific to this site is the use of streets and lane ways. Street access is directed for costumers while the laneways is where industries expand and open their doors offering a fascinating display of diverse production activities. For this reason, respecting the laneways is key in preserving existing activities. Moreover, the use of laneways could be intensified by allowing other uses such as coffee shops, retail and restaurant to animate this urban space. Another issue with the introduction of residential uses into this industrial zone is the incompatibility with many of the existing industries activities. While increasing density is essential for the creation of lively and dynamic communities, it is vital to do so by indentifying the areas of the site that are more compatible with residential uses. In addition, it is important to introduce building typologies that enhance the local conditions and preserve industrial uses while allowing for a wider range of commercial, office and recreational activities.

The analysis of the site also allows for a deeper understanding and detailed exploration of the existing conditions. The site analysis, also offers the opportunity to identify qualities to preserve, principles to extract and guidelines to follow for the development of this area. Moreover this is an adequate scale for the exploration of spontaneous and elastic phenomenon similar to the observations done in Mexico City.

Elastic phenomenon. Though several site visits and continuous observation, it was possible to start discovering the manner in which users adapt, transform and modify built form regardless of rigid regulations. A wide diversity of adaptations is done by users or business owners to satisfy needs of expansion, contraction or change in use. The six case studies are located on buildings of different types as well as on distinct block typologies. The aspects recorded are, block location, building location, building current use, building type and process of adaptation. This categorization allowed comparing and contrasting information between case studies. However, it is important to note that this correlation didn't show a connection between the existence of elasticity and block or building location, nor in the actual current use of the buildings. In addition due to the fact that the analysis was done at the street level, it wasn't possible to study if changes where happening at the upper stories of the buildings. Although the study demonstrated that elasticity and adaptability can occur on almost any structure, it evidenced that industrial buildings were easier to change and allowed a wider range of uses and configurations due to their structure,

Figure 54. Location of elastic phenomenon on the site.

envelope type and generous heights. In addition live-work lofts, which have similar qualities to industrial buildings, also proved to have a great flexibility. This lead to the notion that some building typologies facilitate elasticity while others restrict it. Aligned with this idea a brief typological study was developed to explore the qualities of elasticity of diverse building types (Annex A). From this study it was possible to indentify design strategies and techniques that allow for adaptability on industrial, commercial and office buildings which can be incorporated into residential or mixed-use structures.

Studying the *process of adaptation* of each case demonstrated that expansion is done towards adjacent vacant units when available, while in lack of available space the uses tend to spill into exterior public space in a more temporary manner. Expansions towards the exterior also relates to the type of use, for example retail and food commonly make use of the sidewalk which allows attracting customers by displaying activity in the outside. In contrast, industrial uses usually expand towards the lane where manufacturing activities can be performed without

affecting air quality and circulation on sidewalks and streets. The study of these processes also proves that buildings designed with adaptability are able to maintain their quality in terms of light, air, circulation and generosity of space, when transformed overtime. Lastly, each case was explored and synthesized in an axonometric drawing. This diagrammatic technique allowed to scientifically study these events and to identify the elastic components of void, edge and flux. Furthermore the axonometric drawings evidenced the manners in which these three elements of elasticity are materialized and manipulated by people in this specific context.

Figure 55. Comparative matrix of elastic phenomenon.

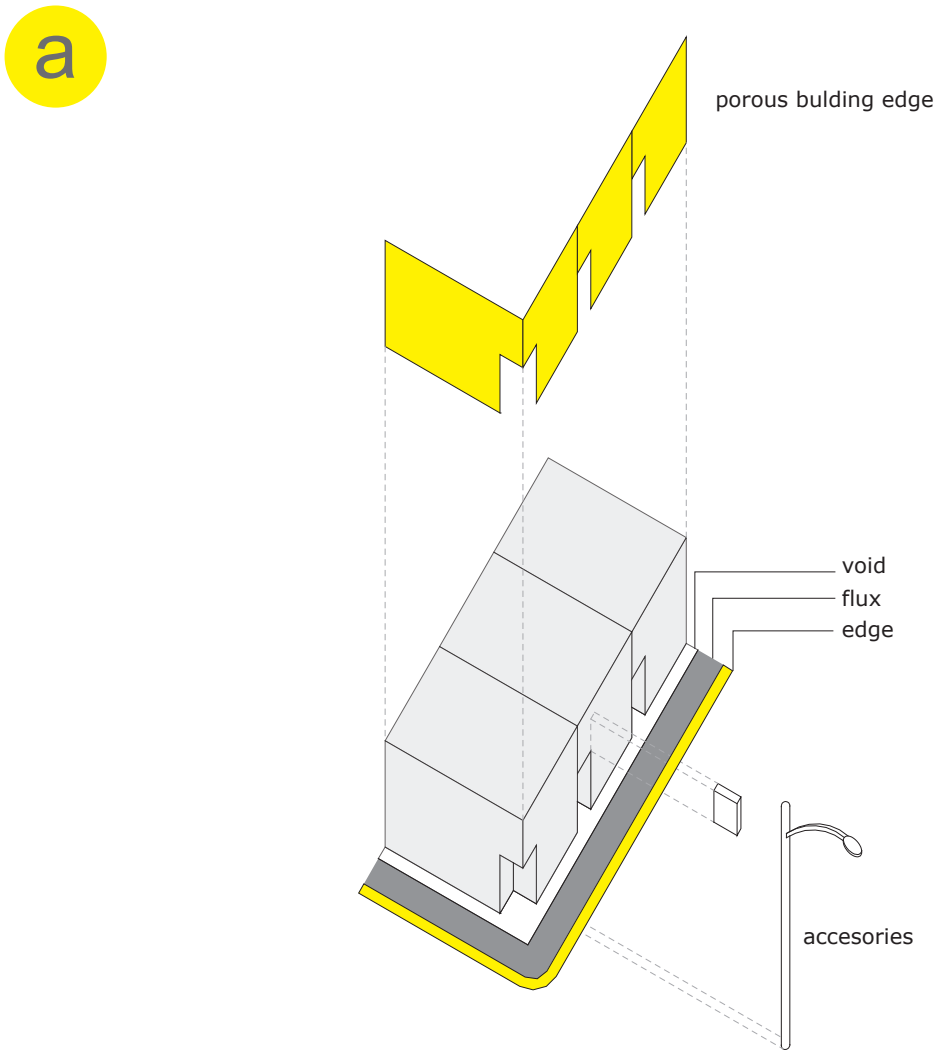


Figure 56. Elastic phenomena A

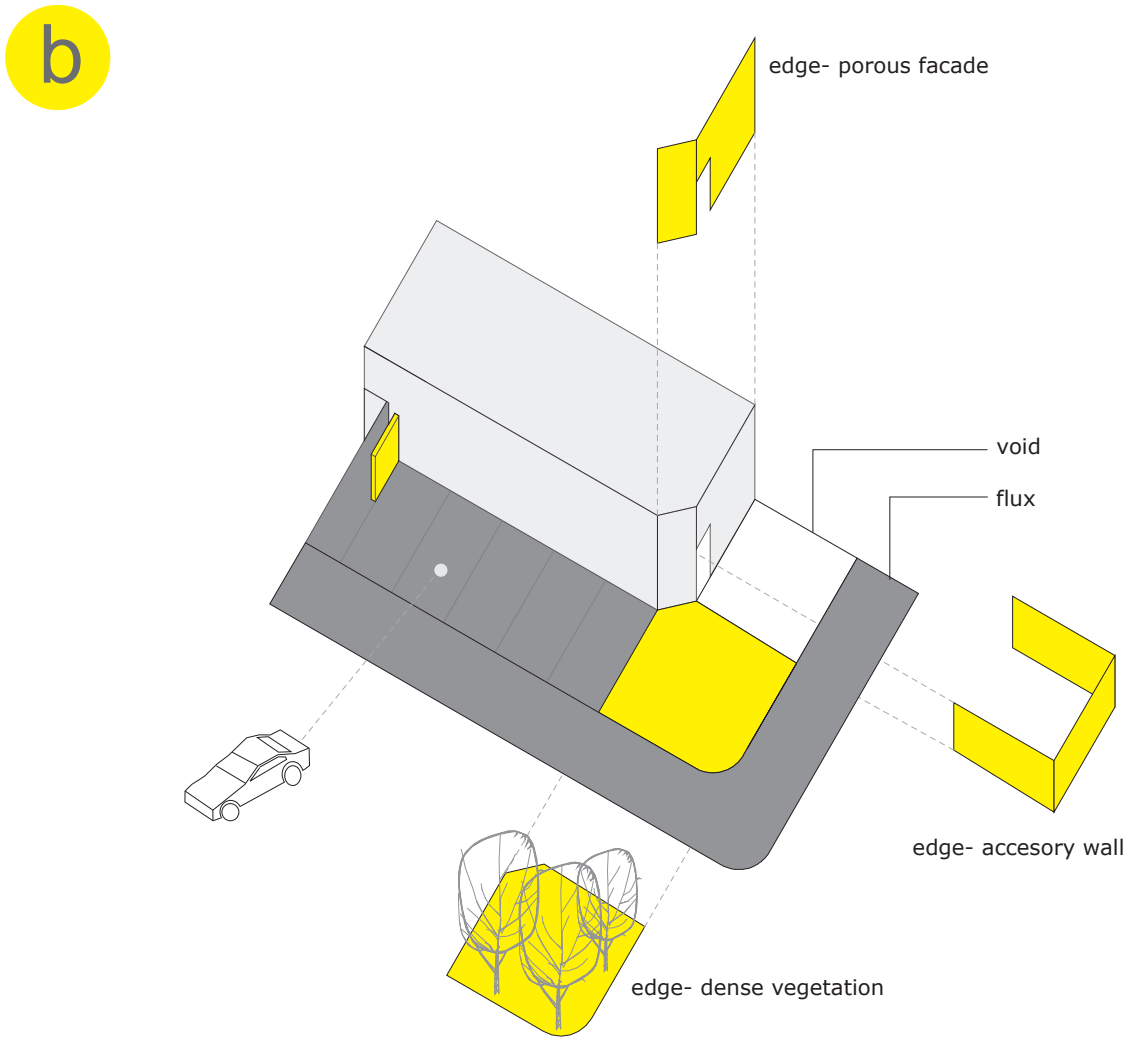


Figure 57. Elastic phenomena B

C

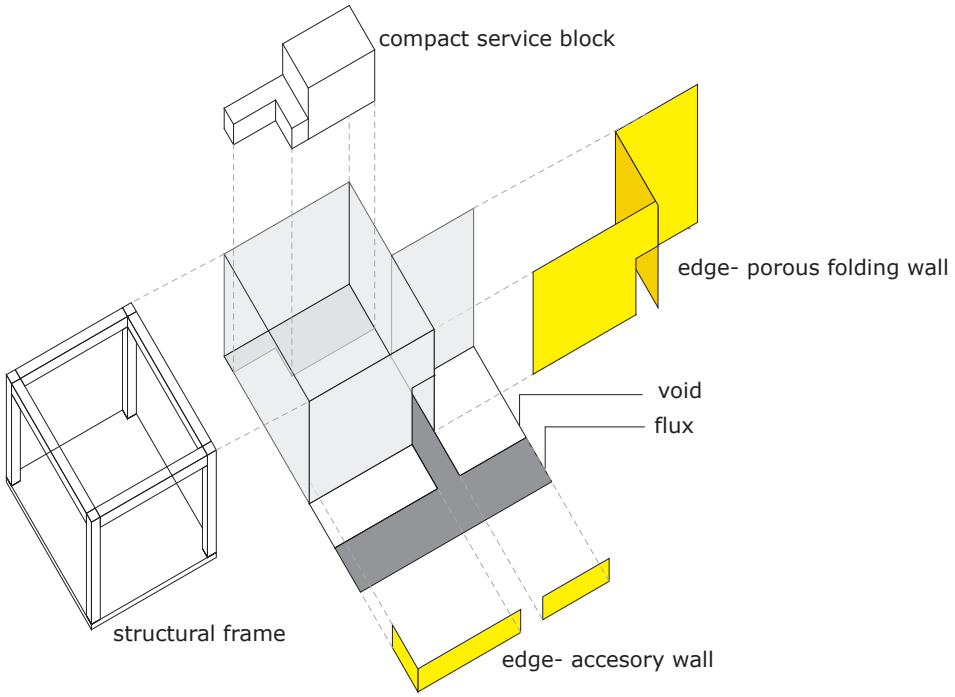


Figure 58. Elastic phenomena C

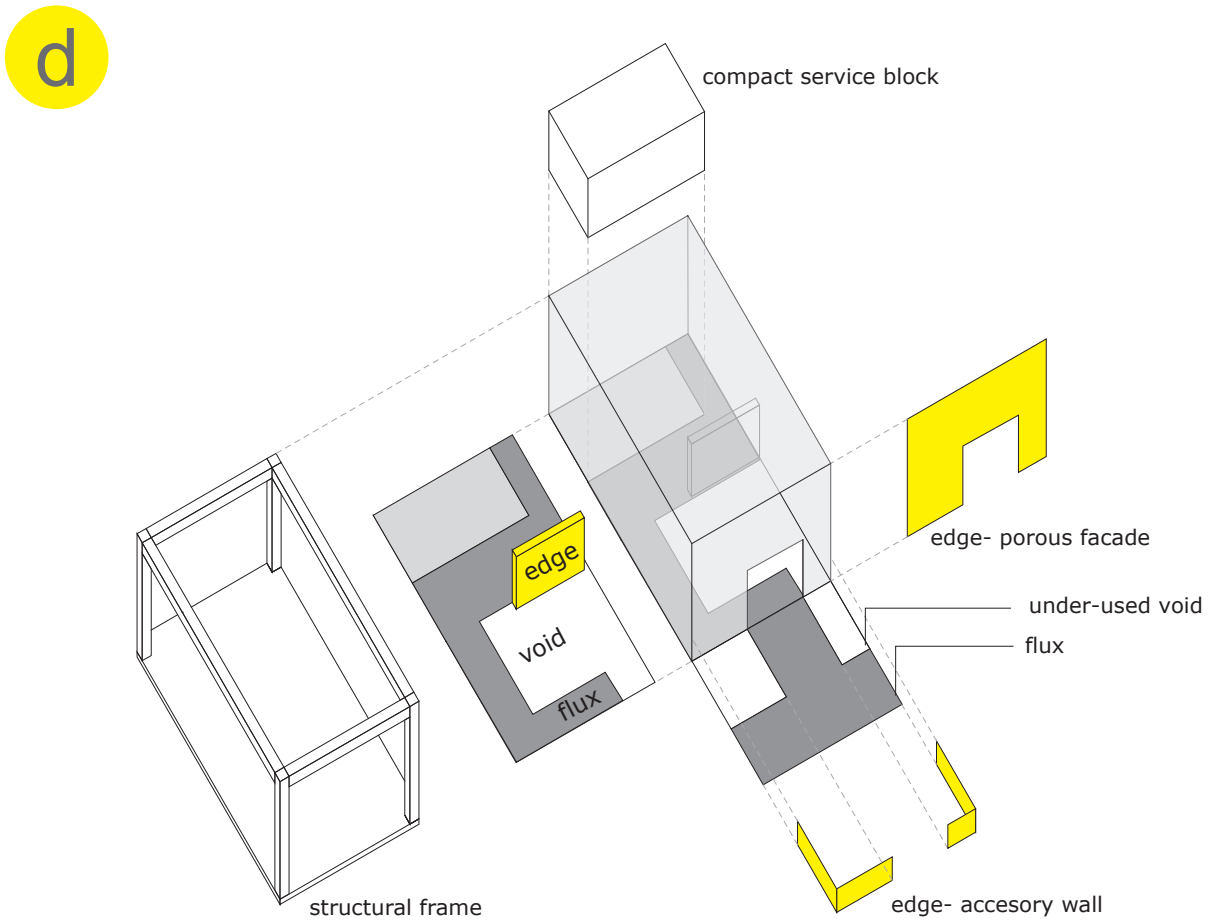


Figure 59. Elastic phenomena D

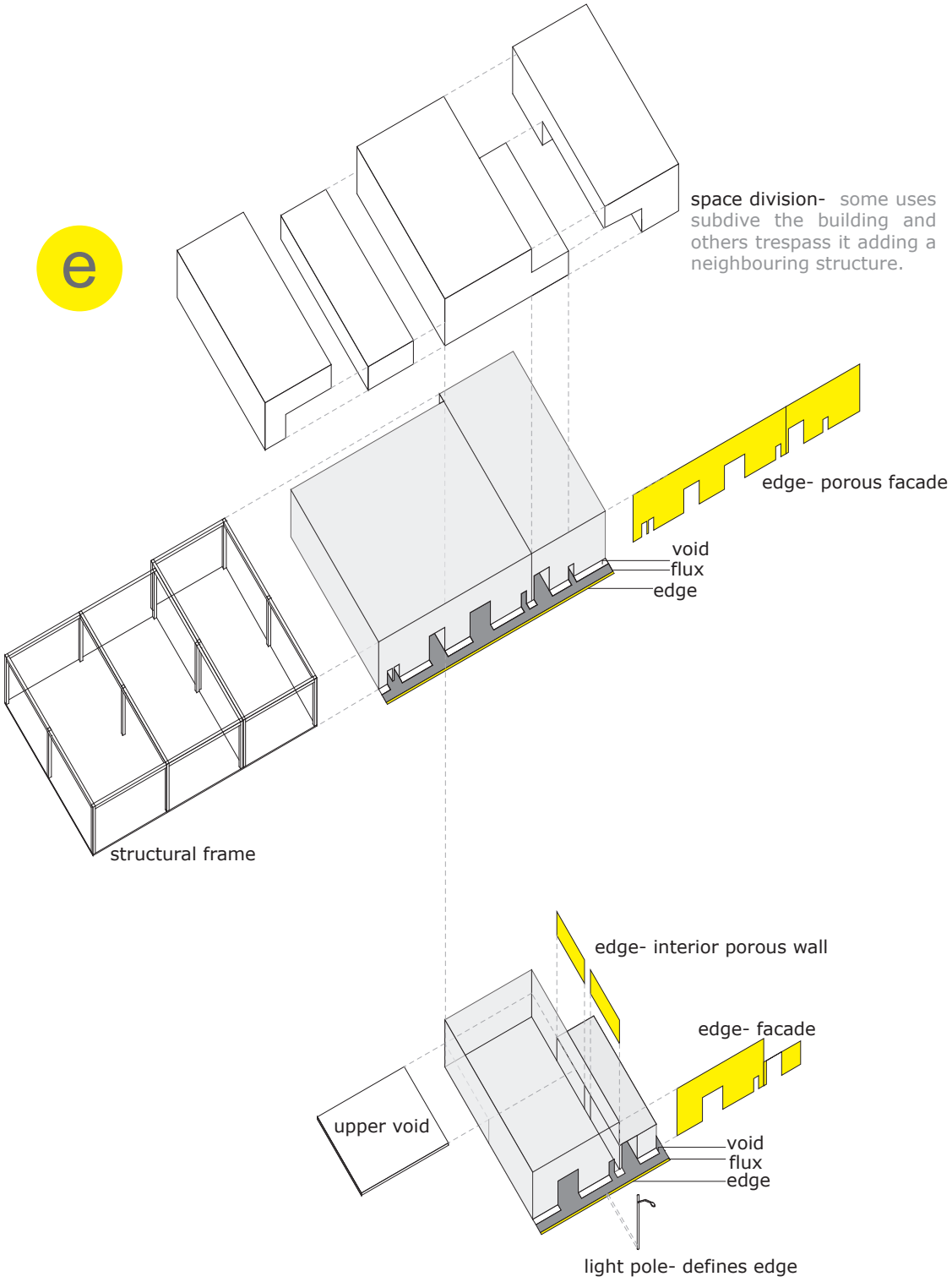


Figure 60. Elastic phenomena E

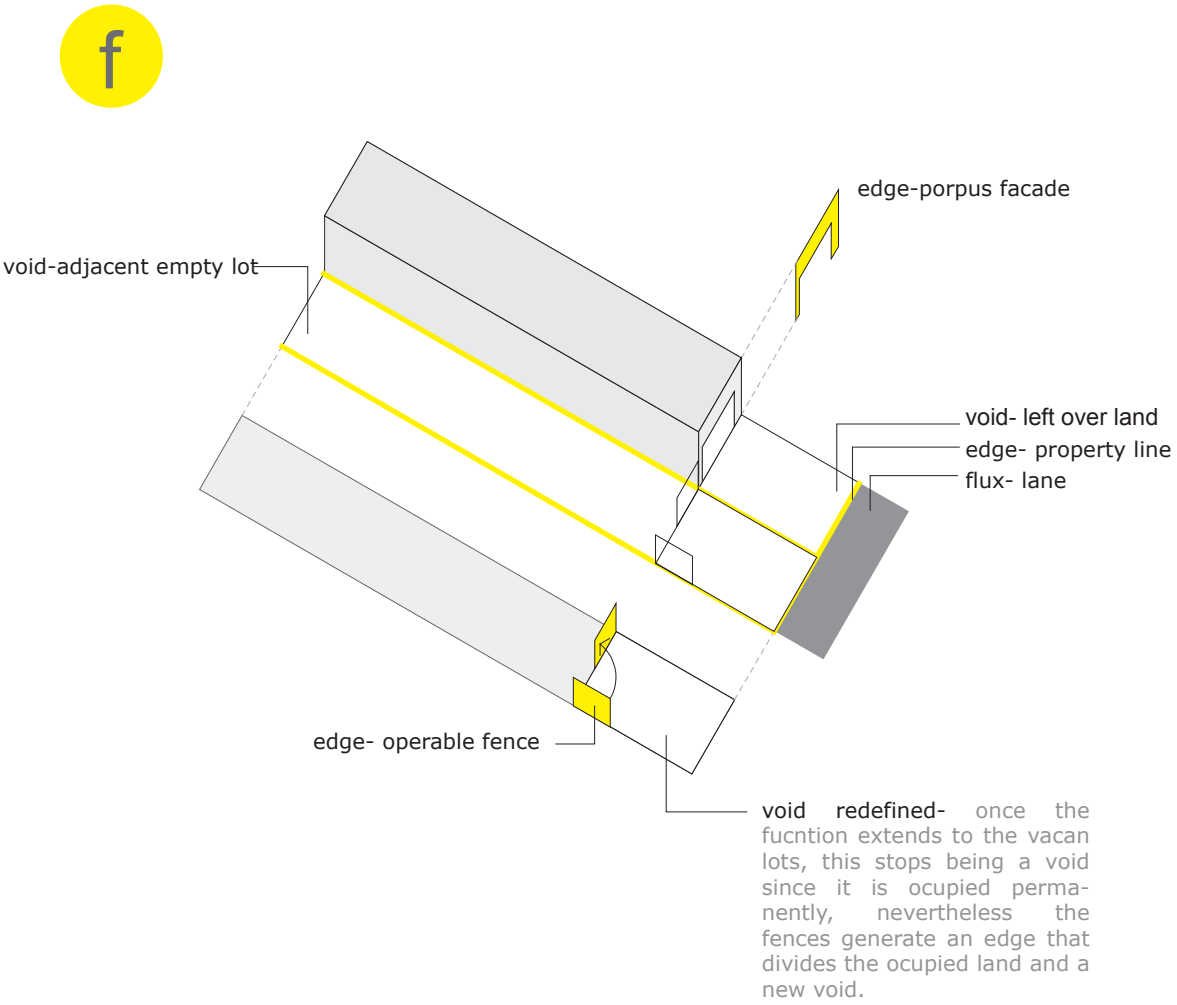


Figure 61. Elastic phenomena F

Summary of the findings. The site analysis facilitated the understanding of the needs of this specific area and its relevance at larger and smaller scales. In the larger scale this site represents a node where three other subareas collide, evidencing the need for the improvement of connections and transitional spaces. In other words the site urges to be unified at the same time that it is important to respect the diverse existing conditions. As the development of the area and its transition from industrial to high-density residential is rapidly occurring, it threatens to gentrify and displace existing uses and users. On the other hand, new construction can potentially transform this hostile industrial environment into human friendly area with a wide diversity of activities.

The analysis and specially the study of elastic phenomenon arises information relevant for smaller scales such as buildings or individual living and working spaces. It is evident that factors such as the structure, envelope, layout and systems of a building have great impact on adaptability. The study also showsthe type of transformations buildings usually go through, such as change of use, addition of use or hybridization of the function of a space, systems update, expansion and contraction. What is more, many of these elastic behaviors presented interaction between public and private space through the extension of private activities to exterior voids. Additionally, *voids* were found to be key generators of elasticity of both interior and exterior spaces while *edges* demonstrated to be important to frame and differentiate spaces in use from voids or flux. Moreover many of the edges found in the cases explored shared the quality of porosity, a new concept for this thesis. Porous edges such as building's walls and envelopes allow activities to permeate into the exterior or neighboring structures facilitating the process of elasticity.

In summary the findings of the site analysis can classified as:

Elastic behaviors

- Clear demarcation of voids, edges and flux.
- Porosity is a desirable quality of buildings edges.
- Separation between skin and structure allows for greater elasticity.
- Voids can be used temporarily or permanently.
- To ensure future elasticity a percentage of voids must be maintained.
- Setbacks, patios, buts and gaps in buildings represent voids that promote elasticity.
- Location of services and circulation has a great impact on the elasticity of a space.
- Allow spaces to grow, extend and transform according to users' needs.

Use behaviors

- Occupy unused hours
- Adjacencies studies allow organizing and mixing activities.
- Contraction of space used for a determined activity liberates space for other uses.

- Issues of adjacency can be negotiated though voids or transition activities.
- Generate spatial modules that allow for diverse activities.
- Circulation and services can help organize location for certain activities and separate public from private uses.
- Provision of light and air determines the location of certain activities and shapes buildings.

5.4 **Block**

After the site analysis and elastic phenomenon analysis the study focused on the block scale. As the site is affected by diverse conditions, the selection of the block was done based on its representativeness and usefulness on a larger scale. While the block studied is unique and has its own qualities it also has similarities that allow extract design principle applicable to the rest of the site.

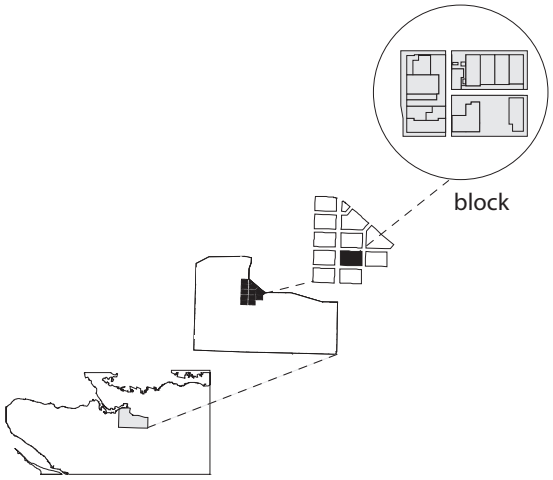


Figure 62. Block location map.

The block selected is framed by Main Street, Scotia Street, Sixth Avenue and Fifth Avenue. By being placed at the edge of a major corridor of Main Street, the building typologies that face this street differ in height and use form the ones facing Sixth and Fifth Avenue. Moreover the block contains a T-shaped lane that allows the subdivision of the block in three sections, each one facing a different street and with laneway access. In general terms the selected block provides a wide variety of uses, voids, building types and elastic phenomenon, providing a rich mixture for exploration.

Void. Initial observations and site visits evidence that the block contains a great amount of vacant land. Some of these voids are empty lots, industrial yards, parking lots and void space generated by building's setbacks. All of this voids offer diverse opportunities for new construction and for activities to temporary animate these spaces. Moreover, later observations showed that some of the voids are in use, for the most part serving as parking space for some of the existing car-repair industries. For this reason when building on apparent vacant land it is essential to consider the existing use and provide alternative spaces for these activities.

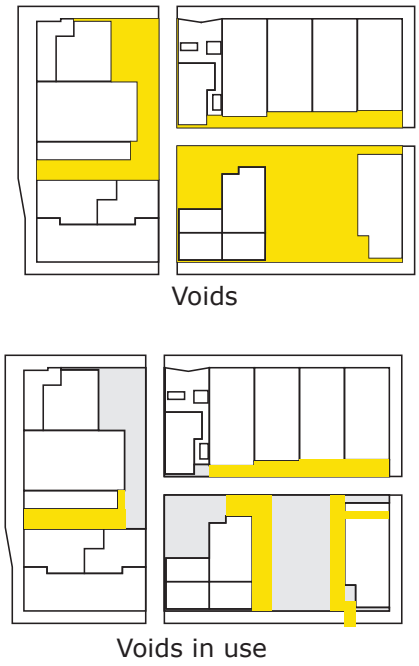


Figure 63. Existing voids, vacant and in use.

Laneway. Laneways are extremely active in the site and block. Most of the industrial uses extend towards the laneway or constantly use it to load and unload products and supplies. As an example, many of the auto-shops located in the block open their garage doors towards the lane to allow for better ventilation and daylight access, additionally they use the lane as extra parking space for the cars that are lined up to get repaired. In this sense laneways are essential for the performance of many industrial activities while having the potential to host other uses such as retail, galleries or cafes that could enhance the quality and diversity of these spaces. Moreover, new building should address the need to preserve light and air access on the laneway which would allow preserving its current use and potentially introducing new activities.

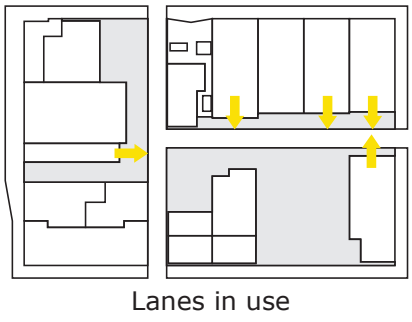


Figure 64. Spaces extending towards the laneway.

Street. The streets that surround the block have different qualities. Main Street by being a wide corridor experiences great amounts of traffic throughout the day which is why it could host taller buildings that would bring the scale down making it a more conformable space for people while allowing for higher densities. Greenery, urban furniture and protected bike lanes could also be placed on this street breaking the street into different zones for

diverse modes of transportation and inhabitation. The side streets, Fifth and Sixth Avenue are narrower and more calmed which makes them appropriate for medium densities where coffee shops, galleries and smaller scale commercial activities could be located and spill into the sidewalks. The design of these streets could also incorporate vegetation and furniture that encourages people to inhabit the urban landscape. In addition traffic calming strategies such could help to generate a separate environment from the one on Mains Street. Scotia is a street that is generally disengaged from existing structures that don't provide access form this street but from Fifth or Sixth Avenue, therefore, modifications to existing buildings or construction of new one could help to generate a better interaction with Scotia Street.

Figure 65 has been removed due to copyright restrictions. The information removed include a showing the views from the streets that surround the block of study

Figure 65. Views from streets surrounding the block of study.

http://maps.google.ca/. Accessed: August 2010.

Use. The block contains three types of uses, residential, industrial and commercial. Although there a mix of uses at the block scale, the activities are not mixed in the building scale; the exception are two buildings one commercial-residential and another one with live-work artist studios. In terms of the location of uses, commercial activities are placed along Mains Street, while industrial uses are located along Fifth and Sixth Street. While commercial and industrial uses follow clear location patterns, the existence of only two residential buildings make it harder to read a patter for their location. One of the residential structures is located on Main Street and the other on Fifth Avenue, two streets with very different conditions, which may just be a reflection of the different times they were built.

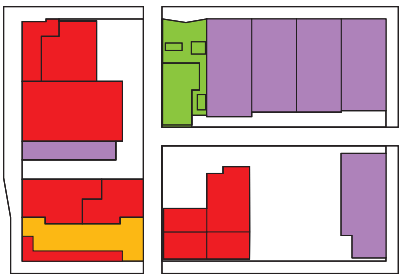


Figure 66. Existing uses.

Setback. Building's setback from the street is regulated by policy and allows having a continuous aligned street front. Moreover, street setbacks provide void spaces for extension which can be used by industrial, commercial or

residential activities. In contrast, setbacks on the laneway seem to be unregulated due to its variability providing a more dynamic streetscape with a diversity of voids that can provide space for a wider range of elastic events. As new construction comes in place, laneway setback will need to be regulated but not standardized, ensuring the permanence of a diversity of voids. This could be regulated by providing a range instead of a fixed setback distance.

Figure 67 has been removed due to copyright restrictions. The information removed include a diagram about buildings setbacks.

Figure 67. Buildings setback generates a continuous street front.

http://maps.google.ca/. Accessed: August 2010.

Connection. If the laneways are to be transformed into more vibrant environments it is important to facilitate pedestrian access. This can be done by generating pathways between buildings that connect the street with the lane, or by opening up plazas at the laneway entry points which would provide a more pleasant and welcoming experience. In addition opening up the access towards the lane will also provide visual connections which are important for people to discover the activities located in these spaces. In these sense visual connections is as important as facilitating flux between street and lane.

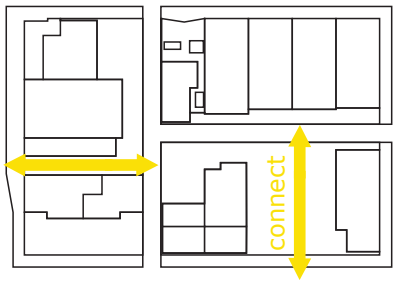


Figure 68. Connection between laneways and streets

Guidelines. Observation at the block scale allowed identifying aspects to be changes as well as the ones to be preserved. Moreover the analysis at this scale also allows moving beyond the observation and start providing possible solutions or alternatives to improve the existing conditions. The following guidelines while being generated at the block scale also inform larger scales of the site, neighborhood and city:

a) Protect lanes to ensure permanence of existing industrial activities.

b) Conserve small lots to promote architectural and use diversity.

c) Generate responsive density that negotiates with existing conditions and buildings.

d) Preserve a percentage of existing voids to ensure future adaptability and elasticity.

These guidelines are specific enough allowing to move forward into the design intervention of this project. At the same time the guidelines provide a general framework for their application to other blocks within the site. While it is important to understand the specific conditions at this scale, it is also important to remember that the connection to the larger context has a strong influence on the elements encountered on each block.

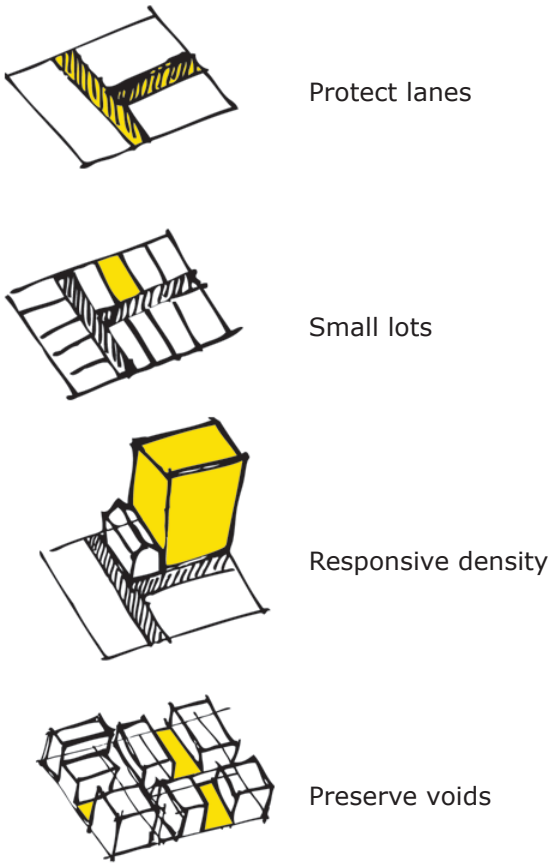


Figure 69. Guidelines generated from block analysis.

6. **Intervention**

6.1 **Lot**

The selected site for the intervention is a vacant lot in the block of study. The vacant state of the lot allows providing solutions that can be applied to other locations. While the generic character of the intervention lot is a desirable quality for this study this does not mean that the building response will be equality generic. In contrast the site analysis shows that the lot is situated within a wide variety of local conditions which are taken into consideration in the intervention phase of this thesis. Engagement with neighboring structures, street and lane are some of the aspects to be addressed, additionally natural elements such as orientation that ensures access to light and air also mandates on the shape of the building to occupy this lot.

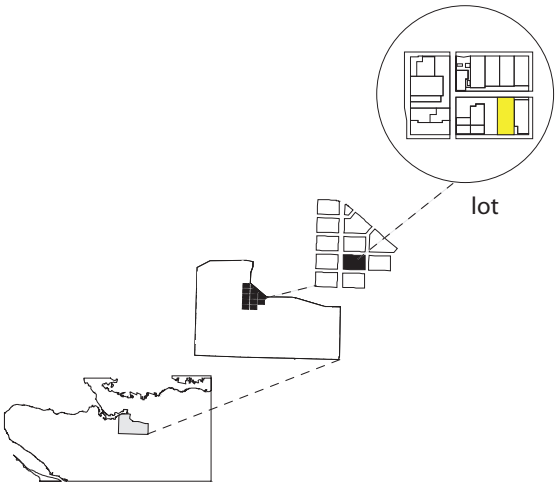


Figure 70. Location of the lot of intervention.

One of the challenges of facing and empty lot is the danger of assuming that anything and everything can be placed on it. However, as mentioned before, development in this site is conditioned by both local and global factors. On one hand, new construction on this lot must comply with density requirements aligned with the city growth vision of the Planning Department of the City of Vancouver. Based on the study of neighboring structures, new developments aim for the maximum density possible while not surpassing a height of eight levels. Nevertheless this maximum height is adequate for mega-project that occupy several lots of in some cases the entire block, which is not possible when building on a single lot. Another aspect to consider in the design of the structure to be placed on this lot is that it should allow for a wide diversity of uses compatible with the existing ones. In consideration of these large scale factors and the specific qualities of the lot and block, it became evident that the selection of an adequate building typology can address many if not all of these aspects. In order to facilitate the selection of the building type the researched explored other locations in Vancouver with similar lot and block conditions.

Vancouver's Chinatown is well known for its long and narrow lots with old and new mixed-used buildings. The observation of aerial photos of this area showed that most buildings contain courtyards of diverse shapes to ensure access to air and light to each unit. While older buildings do not surpass four stories of height newer constructions reach six stories. This height difference is the reflection of policy regulations and building technologies available at the time. While the six stories limit allows higher densities, it also ensures access to light. Something not achievable with higher structures in such narrow lots. In this typology the circulation tends to be located in at the middle of the lot connecting two volumes of dwelling units, one facing the lane and the other the street. In terms of use,

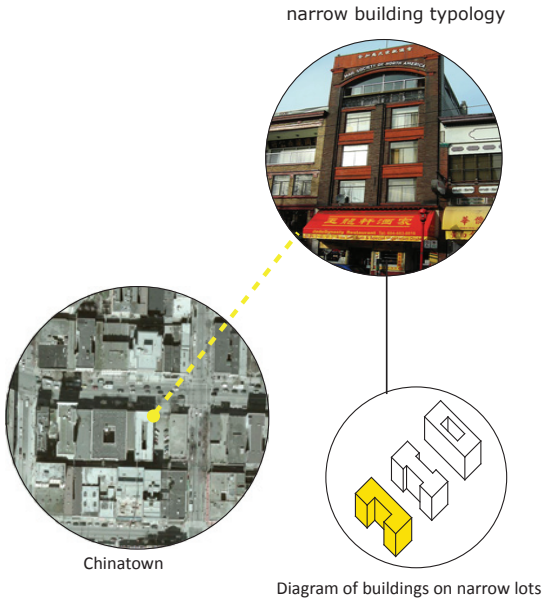


Figure 71. Exploration of building typologies for narrow lots.

this building typology commonly contains commercial spaces at ground level and residential on top. The location of the commercial uses allows having either long units with access through the street and lane or two separate ones, with one facing the lane and the other to the street.

In summary, the study of local and global conditions affecting the lot of intervention provides direction and restricts the freedom while facing a white-canvas situation. Moreover, the study of similar lot types allows identifying adequate building typologies to work with. However, the typology selected needs to be further developed and contextualized so it responds to the specific conditions of the lot of intervention.

6.2 **Building**

This section contains the last stage of this thesis's elasticity study which is presented as a design intervention. The objective with this intervention is to reach smaller scales such as the one of the building and dwelling unit. In addition, the design also aims incorporate elements that facilitate people's interaction with the built form. Moreover, the design of this building and the dwelling units within, allows demonstrating the manner in which the pieces extracted from research and analysis are brought together, in this sense, this design phase serves as a compilation of knowledge. The ideas integrated into the design come from theories and literature reviewed, analysis performed on diverse scales and context, and study of elastic components of diverse buildings typologies. From this diverse information it is possible to extract guidelines and suggestion on how to achieve greater elasticity while respecting and responding to the surrounding environment. Some of the ideas taken into the design stage are the following:

- From the literature reviewed on Chapter 3, it became evident that the design of every component of a building can allow or restrict elasticity. In order to ensure elasticity, the literature reviewed recommends generating a clear separation between the diverse systems of buildings which allows modifying one element without affecting others. Moreover, the literature suggests a clear differentiation of permanent elements from temporary ones that can be transformed and moved without altering the correct functioning of a space.

- The brief exploration of diverse buildings typologies exposed the elastic components of industrial, office, residential and commercial spaces. These elastic elements can be extracted and incorporated into the design of one adaptable structure.

- The analysis of the site showed the relevance of responding to the context by negotiating and engaging with neighbouring spaces, structures and functions. Moreover, the study evidenced the importance of generating spaces that relate to human scale, both on the street and laneways, which promotes human inhabitation and movement through the site. In addition, the analysis of buildings on the site evidently showed that demarcating spaces of diverse functions and with different privacy requirements allows easily transforming and repurposing a space without affecting an adjacent function.

- The study of diverse elastic phenomena, made it possible to identify three main components of elasticity: void, edge and flux. Moreover, the findings demonstrated that these three components can vary in size, shape and configuration while still allowing for elasticity. Additionally, it became evident that the provision of diverse types of voids connected by clear flux allows activities to sprout in a spontaneous manner generating vibrant environments.

- The study of residential building types that are appropriate for the lot of intervention, demonstrated that access to air and light can importantly influence the elasticity of a space.

As this section presents the smallest scales explored for this thesis, it allows demonstrating the big impact that small interventions have on urban environments. At this point, it is important to remember that the city is nothing but a system of smaller and interconnected elements. Therefore, this thesis sustains that creating elastic cities requires designing for elasticity on the small scale and consequently, the large scale will become elastic by means of its connection to the smaller components. In other words, a single building or dwelling unit designed in an elastic manner can have great influence on adaptability at the city scale. Another aspect to consider when acting on the small scale is the role of the user. As explored on the analysis of elastic phenomena, people, when given space to appropriate, will modify their surrounding environment in order to satisfy their needs and desires. For this reason, this thesis looks forward to create spaces where people can freely and actively transform their living spaces in order to satisfy their individual needs. Moreover, the design of the buildings aims to provide a structure that serves specific functions while allowing for the reconfiguration and transformation of space. This thesis aims to produce a space for the unplanned and spontaneous phenomena.

The design phase of this thesis required creating a building that acknowledges the specific context and site conditions while integrating elements of elasticity that were identified through the different stages of this thesis. Gathering such complex information and translating it into built form was achieved through the following operations:

a) Generate two main volumes with a central courtyard that provides access to light and air. Moreover, the courtyard allows ground floor activities to expand and animate this space. In addition, these two volumes allow having multiple access points that facilitate the subdivision of larger spaces into smaller one while still containing an entrance.

b) Subdivide the two main volumes in four, two with ground floor access designated to host commercial and industrial activities. Two larger volumes are located on top of the commercial and industrial uses and contain

live-work spaces.

c) The ground floor volumes are setback from the street and laneway respectively, generating voids where commercial and industrial uses can extend. In addition, both volumes setback from the lot edge on the right generating a pathway that connects the street and laneway. This path also engages with an existing open space on the neighbouring building.

d) The top live-work volumes are given different heights in response to orientation providing light access to the lane and interior courtyard. The volume fronting the street has six stories while the one facing the lane has four. These heights also address the need to respond to human scale and street width.

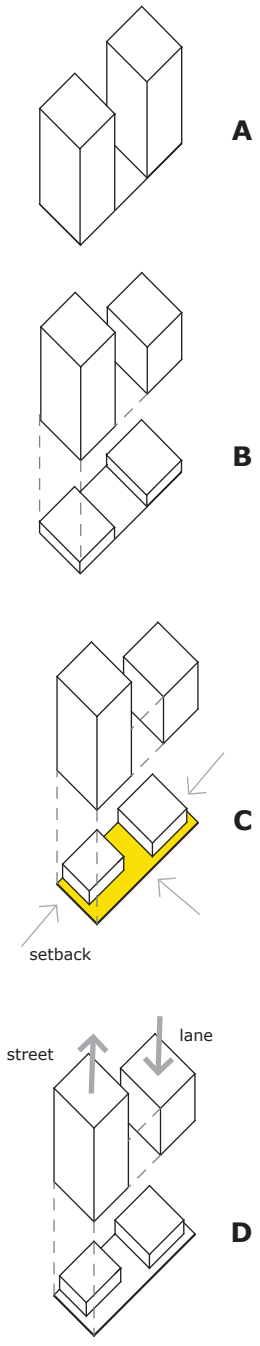


Figure 72. Initial design operations

These four basic operations facilitated the generation of a volume that responds to the conditions of the site. Once the base of the buildings was generated it was possible to move forward and developed the design with a greater amount of detail. While initial massing operations ensured that the building engages with the street, laneway and neighboring structures, later design moves allowed negotiating between external responses and interior function. Therefore, finding the middle ground between the overall volume requirements and the design of individual dwelling units produced a more complex volume that satisfies the functions of each space, responds to the context, and generates elasticity. The following classification describes the concepts that lead to the introduction of elastic principles and components into the building:

Void. Diverse types of voids are introduced in both the building and unit scale. The voids were designed to serve one or several of the followings functions: ensure access to light and air, facilitate circulation though the building, and provide adaptable space to be repurposed according to user's needs. At the building scale, permanent voids secure access to light and air to each commercial, industrial and dwelling while generating courtyards and patios where interaction connection and social engagement can occur. Another layer of voids is composed by spaces that can be occupied in a temporary manner such as corridors and spaces produced by the building's setbacks. Additionally, each dwelling contains a void space that is to be adapted by the inhabitants; this space is semi-separated from the residential function allowing for great flexibility. Moreover flex spaces of the dwellings can extend towards the temporary voids generating interplay between inside and outside. Therefore by means of the interaction and integration the void space of the building can expand and/or contract in response to adjacent activities.

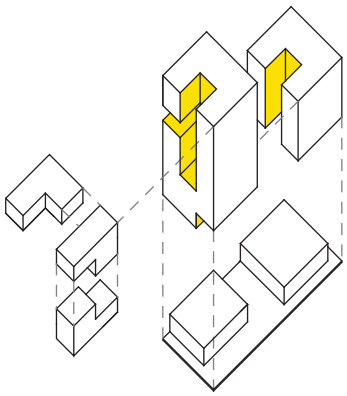


Figure 73. Designing the void

Edge. The building has been designed to have a clear demarcation between functions. While the design promotes a diverse mix of uses, it also delineates edges which ensure the correct performance of one activity without obstructing another. At the buildings scale, edges allow differentiating public from private space. The building, while allowing public access to the courtyard, intends to clearly mark the edge between the street, which is totally public, and the semi-public courtyard. This differentiation is achieved through the provision of visual edges or entryways protected by overhangs that provide wide access to the courtyard while delineating the entrance to a

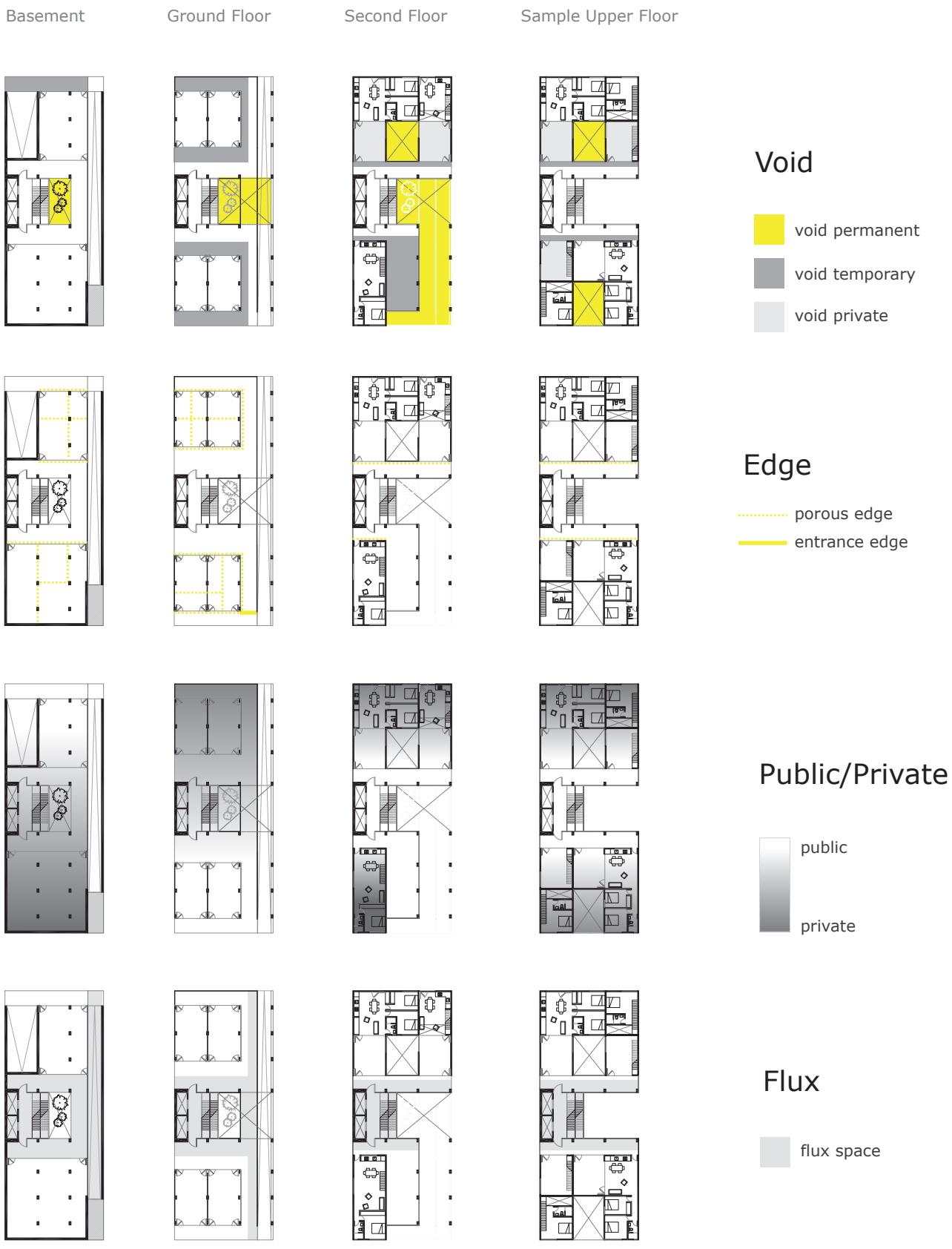


Figure 74. Building plan diagrams

more private space. In addition, the commercial-industrial units located on the basement and ground level contain porous edges that allow their functions to permeate into the street, laneway or courtyard in a temporary manner. These types of elastic extensions challenge the notion of private and public space while redefining the edges of the building. On the upper live-work levels, dwellings have been designed to have a clear but flexible edge between private and public space by the provision of diverse thresholds that allow users to redefine the limits between one function and another, or between the interior space of the unit and the hallway.

Public and private. As the intention is to promote the emergence of a mixture of diverse uses and activities, this implies a careful organization of public and private spaces. At the building scale the ground floor has a public character by containing an open courtyard that connects with the street and laneway, in this manner people can move throughout the building as if it was an extension of the public realm. Moving to the upper levels, the building becomes more private as it hosts residential activities. Nevertheless, the units contain elastic spaces that can be given diverse uses which can have a more public character. In this case, privacy is achieved by locating the elastic spaces closer to the hallways which represent a semi-public zone. In contrast, residential functions tend to be located further from the hallway. Within the residential functions, spaces such as the kitchen, living and eating area are placed at the front, closer to the hallway, and the sleeping areas at the back. In this manner, the dwelling is organized in three areas with different degrees of privacy. What is more, circulation spaces such as hallways, staircases, corridors and even the courtyard have a public character and promote encounter and interaction between the residents, visitors and people walking by or through the building.

Flux. The design aims to have efficient circulation and to connect people as they move through the building and to integrate with the urban fabric. A ramp connects the street with the laneway, while a parallel pathway brings people into the courtyard; and as a consequence the building becomes an element of connection at the building and urban scale. Fluxes also favor commercial or industrial functions located on the basement and ground level by promoting that people continuously pass by these spaces. What is more, the flux adjacent to commercial and industrial uses is separated from the edge of these functions by a void that allows the activities to extend outwards without obstructing circulation. Vertical circulation is located at the center of the building while giving priority to the staircase rather than the elevator. Consequently, vertical circulations become a central component where social engagement and interaction can be allocated. At the unit scale, internal fluxes are designed in an efficient manner avoiding obstruction or overlapping of activities. The circulation within the dwellings, allows separating the functions of the residential area and the use given to the elastic space adjacent. In this manner, users can move towards the residential portion of the dwelling without disrupting the activity performed in the elastic space.

Connection. The building is designed to facilitate interaction and connection. As mentioned above, ground floor circulation cut connects the street with the laneway by means of a ramp that cuts though the building and integrates it with the urban fabric. Additionally, vertical fluxes generate visual connection between people at the interior of the building which allows identifying elastic phenomena created by time on neighbor's dwelling units. What is more, vertical fluxes such as staircases become spaces for social exchange and interaction by promoting the encounter with others. At the unit scale, the creation of double-fronting units permits people to not only connect at the interior but to interact with the life on the street. Finally, two roof garden located on top of each one of the live-work volumes provide views towards the mountains and the city; this spaces connect people with nature and other urban spaces in the distance.

Elasticity. Through a series of simple mechanisms and design strategies the building becomes a field for elasticity. While the structure is meant to serve specific functions, it is also equipped to receive new uses and to transform over different time-frames. While some changes may occur over years, others can take place in the course of a day potentiating the dynamic properties of the building. This dynamism is created by the provision of voids, clear edges and the location of fluxes that trigger elasticity and empower people in the transformation of their surrounding environment. Through the interaction between voids and spaces adjacent to them, the building's functions extend and contract while promoting the interplay between inside and outside, and challenging the division between public and private space.

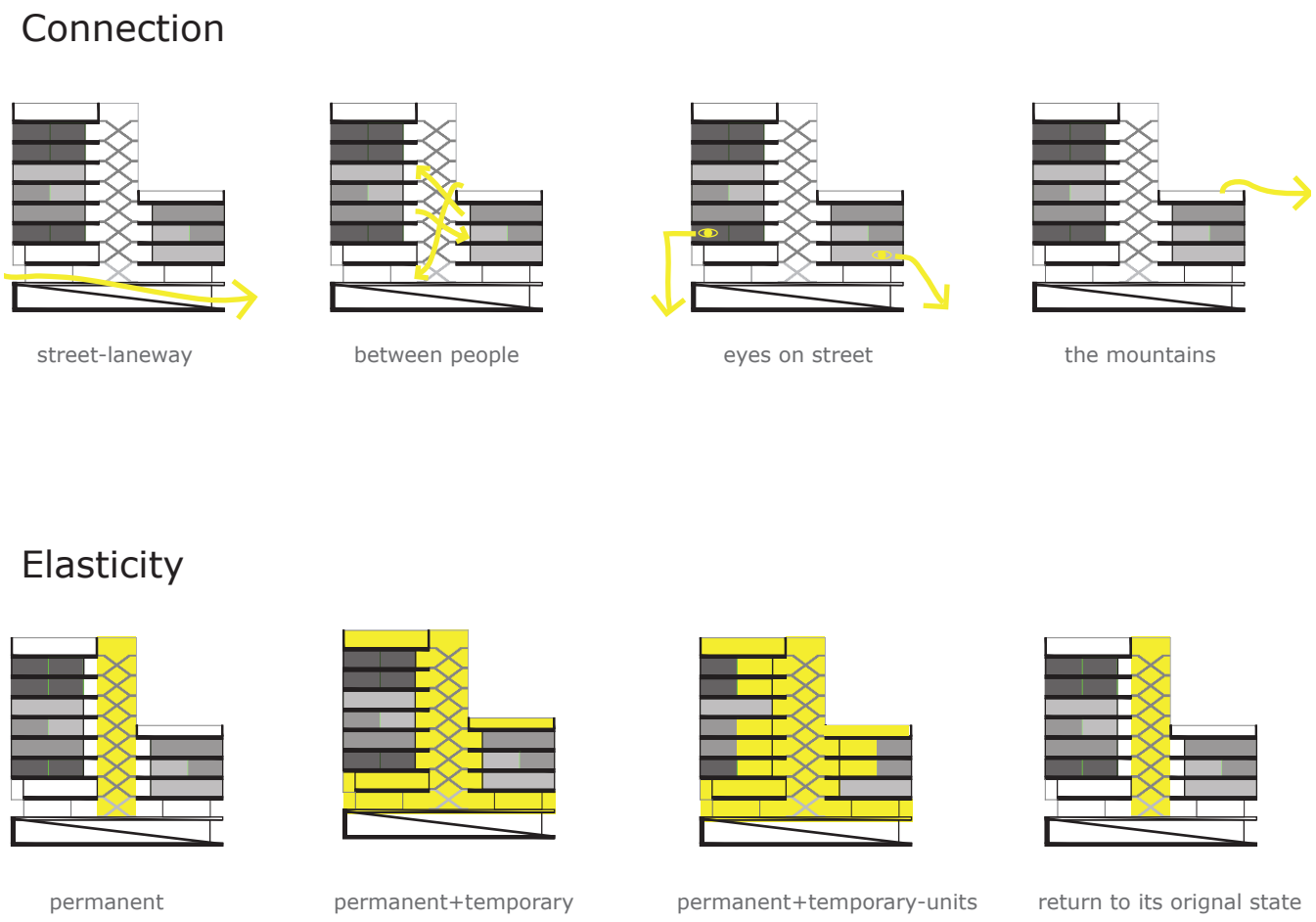


Figure 75. Connection and elasticity section diagrams

Generosity. Through the analysis and research it became evident that *generous* provision of space allows for greater elasticity. For example industrial buildings with high ceilings and open plans facilitate the introduction of second stories and the easy partition of space. Additionally, on the exploration of elastic phenomena, the location of such events was usually related to the existence of additional space without a specific function allowing appropriating and repurposing the use of the space. Therefore the idea of providing *generous space* became a key concept for the design of the building. Hallways and corridors at the ground and upper levels are provided with additional width which generates voids that allow activities to extend in a temporary manner generating an interplay

between public and private space. At the unit scale, each dwelling is provided with, literally, an extra room that doesn't have a specific function but is equipped to host diverse uses which can either be compatible with residential functions or totally independent. Finally, the building contains some larger voids that serve as common patios or terraces available to all the residents and therefore, promoting social engagement.

Intensity. The design aims to achieve a high intensity of activity in and around the building throughout the day. By allowing for diverse to coexist in proximity or by sharing space, the building can become a hub of activity. At the basement and ground level, diverse commercial and industrial activities can subdivide spaces according to their specific use requirements while engaging with the public space by extending towards the street or laneway, and as a consequence intensifying the use of these public spaces. In the upper levels, voids located inside each unit allow for diverse activities to sprout throughout in direct response to individual and community needs. Additionally, several voids are designated for gathering, social interaction, gardening and recreation add other layers of activity to the structure. Overall, the design of the buildings intends to generate a framework that while satisfying specific functions, allows for a wide diversity of uses and activities.

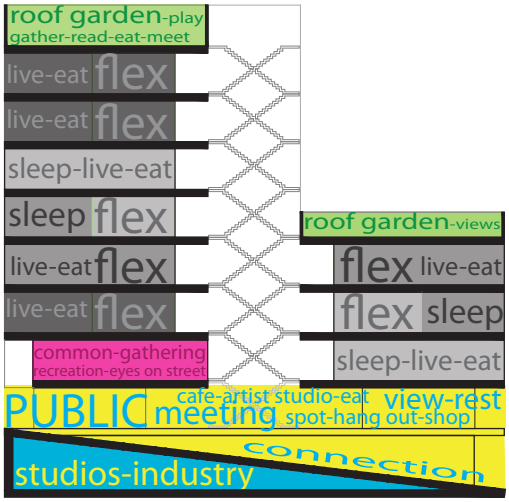


Figure 76. Use intensity in section diagram

Learn from the existing city. The design of the building intends to be innovative without the need to reinvent construction. Thus, it departs form well known existing typologies and by producing small modifications creates a new and more adaptable type of structure. Existing typologies that have proven to function well through time offer a departure point where the strengths are kept and the weaknesses are replaced or improved. This work strongly states that it is important to learn from the existing city and existing buildings, however this should not limit our imagination when proposing new models.

6.3 **Units**

Two live-work volumes are located on top of commercial and industrial uses containing four different dwelling typologies. Each one of these typologies has been designed according to the concepts of void, edge, public/private, flux, connection, elasticity, generosity and intensity explored at the building scale. The application of these diverse concepts at the scale of the unit aims to demonstrate the importance to follow principles of design across scales. For this thesis, the unit scale is the one that is in closest proximity to the human scale, therefore it is within the units that design should empower individuals to transform their living spaces in order to satisfy their needs and desires. Therefore, if the building scale acts a mediator between people and the city, it is the unit that mediates between the people and the building. Moreover, by designing units that are highly elastic trigger dynamism and transformation at all scales.

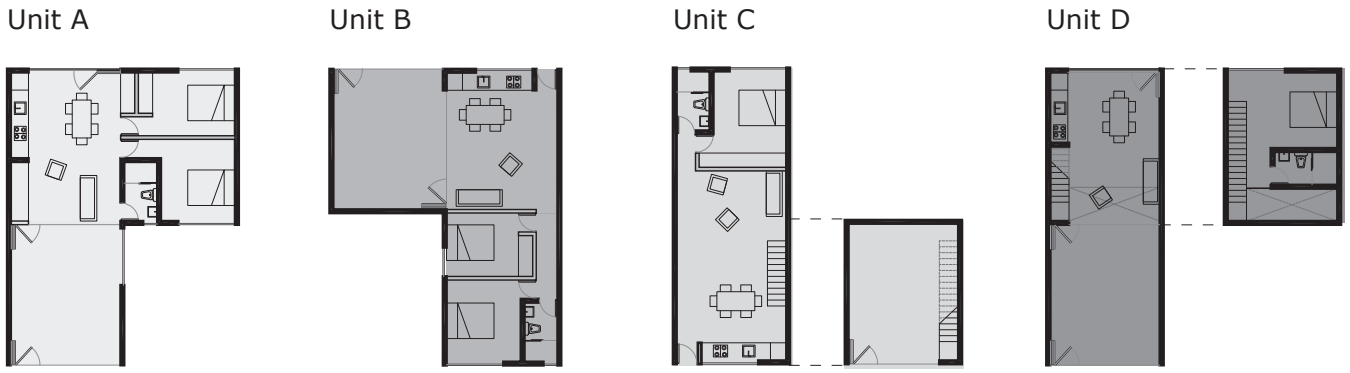
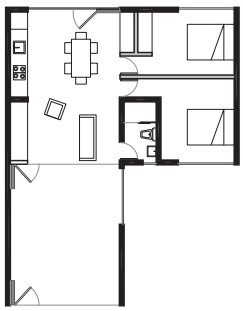


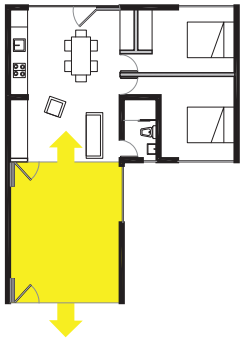
Figure 77. Unit types plan view

The form and layout of the units allows them to be stacked on top of each other while articulating the permanent voids that bring light and air into the building. In addition all the units are double-fronting ensuring access to light and air to all the spaces inside the dwellings as well as generating visual connection with the street (or laneway) and with social interaction others at the interior of the building. Furthermore, all the units are provided with an equivalent area that contains living, bathing, eating and elastic spaces. However, the unit types differ in the number of bedrooms where units A and B contain two bedrooms, while units C and D have one bedroom. Another difference is that units A and B are single storey typologies while units C and D are split between two levels which generate diverse forms of spatial organization. While the units have some clear differences, the design of these types also aims to achieve an equivalent quality of space and a high degree of elasticity in all unit types. These common design principles at the unit scale are exemplified in figure 78 which demonstrates the spatial qualities of Unit A. While the diagram is specific to one unit type, the spatial qualities are very similar to the ones of the other units. This can be summarized in the following categories:

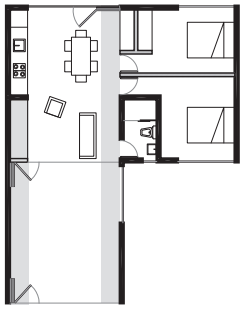
Void. Each united contains a void space that is basically a room without a specific function but equipped to receive diverse uses. By being adjacent to the hallway, the function designated to the void is able to expand towards the exterior of the unit generating interaction between public and private spaces. On the other hand, the void within the unit can also be integrated, permanently or temporarily, with the living functions of the dwelling. In this manner the void becomes almost a thickened edge that negotiates between activities inside and outside of the unit.



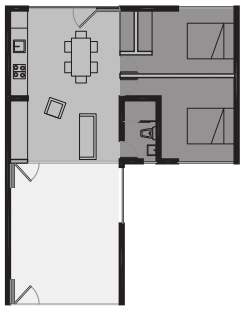
Unit A



Void+Edge



Flux



Public/Private

Figure 78. Unit A - principles of elasticity translated into design strategies

Flux. Dwelling units are designed to have efficient and simple circulation to avoid disruption of certain functions. The linear flux allows for people to in and through the living spaces without scarifying the elasticity of the void space provided for each unit. Moreover the location of circulation facilitates wither the integration or separation of uses within the unit in both temporary and permanent manners.

Private and public. The units are designed to have a clear distinction between private and public spaces by providing threshold that generate a snoot transition between distinct functions. On each unit the most public space, the void, is located in adjacency to the hallway, creating a buffer zone between the corridor and the living spaces inside the unit. Additionally, the location of the void allows it to host uses that can be accessed, visually and physically, by the general public. On the other hand, living and dining spaces are given a semi-public designation and represent the transition between the public void and more private areas such as bedrooms and in some cases, the bathroom. The bathroom, however, can be a wild card that could be located closer to the void in order to serve both the residential portion of the unit and the function given to the void.

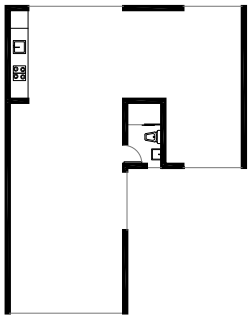
By following these three basic principles, the units are designed as a base that serves specific residential functions while allowing for multiple variations to be generated by people living in such spaces. Therefore, while the building is designed to transform and acquire a vibrant life over time, inhabitation is the only way of achieving these objectives.

6.4 **Inhabitation: from permanent to temporary**

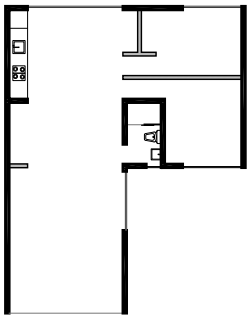
Through the research and analysis developed for this thesis it became evident that elasticity can be facilitated by creating a clear distinction between permanent and temporary components. Permanent elements ensure structural integrity, quality of space, performance of certain activities, and flux thought buildings. In contrast, temporary components create elasticity by allowing reconfiguring spaces, updating systems and redistributing functions, among other types of modifications. Therefore, the design of the building and dwelling units not only separates permanent from temporary elements, but it minimizes the use of the first and potentiates the introduction of the second. Figure 79 illustrates the progression from permanent to temporary components used in the units by means of exemplary diagrams of Unit A.

The most permanent elements are composed by structural wall and fixed components such as kitchen bathroom which can be modified but may require major construction to do so. Moving towards less permanent elements, partition walls are not given structural properties to ensure that these can be easily moved, added or taken out. Thirdly, windows and partition screens are devices that allow users to continuous modify in the ways in which the dwelling integrates with adjacent uses and spaces. Furniture which can be easily moved around and replaced represents the fourth layer of temporary components. This separation of four categories allows the understanding of how the design of the units suggests some type of inhabitation; but it doesn't restrict other modes of living from occurring in the space or the allocation of new activities.

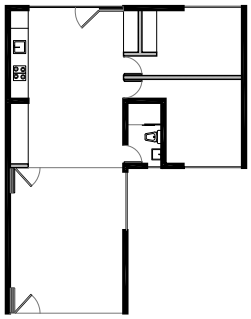
Human inhabitation is a key aspect of elasticity and can be explored as a temporary or as a permanent phenomenon. While a person might permanently reside in a dwelling unit, the manner in which people occupy spaces has a temporary quality. In other words, a person only spends 8 hours in the bedroom and a few hours in the living room, allowing for these spaces to potentially receive other functions while not being used by their inhabitants. In contrast, the manner in which people occupy their dwellings, buildings and cities can also start to generate



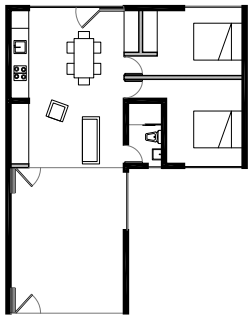
Structure +
Fixed Components



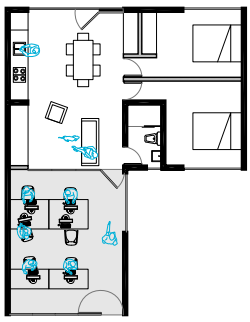
Partition Walls



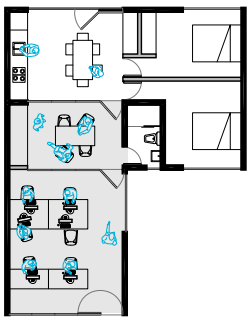
Windows +
Partition Screens



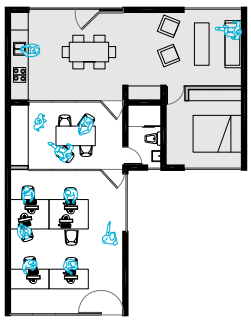
Furniture



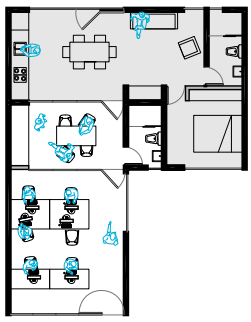
Office



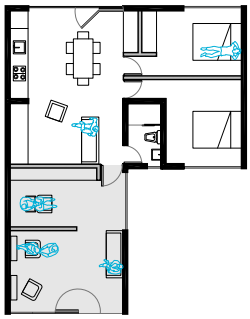
Office +
Meeting Room



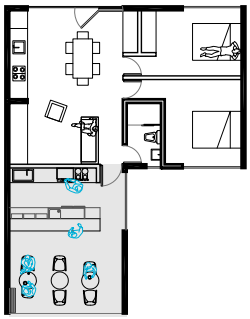
Office+
Meeting Room+
Dweling Variation A



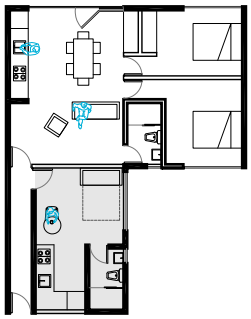
Office+
Meeting Room+
Dweling Variation B



Hair Salon



Coffee Shop



Additional Rental Unit

Figure 79. Distinction between permanent and temporary components within the unit allows for elasticity.

permanent transformation in the built environment. For instance, if a person always uses the living room as a home-office this space might end up formalizing as a proper office and loose the living function. Thus, exploring temporary and permanent human inhabitation allows imagining a series of possible scenarios that could develop over time and start transforming the building. Figure 79 also illustrates the manner in which the elastic design of the units allows for diverse activities to be introduced into the dwellings such as a small office, a hair salon, a coffee shop and a secondary living unit. Uses similar to the ones diagramed on figure 79 can be easily introduced into the unit's void without interfering with the residential functions. Moreover, users can control the degree of interaction between a new use given to the void and their living spaces; this is achieved by the manipulation of devices such as collapsible screens and partitions walls. In addition, the residential portion of the units can also undergo transformation and adapt to the specific lifestyle of the inhabitant, again, the separation between permanent and temporary components make these modifications possible. Furthermore, the design of the units accounted for space requirement of diverse commercial, industrial and office functions which allowed identifying the size and height to be given to the unit's voids in order to ensure maximum elasticity. Consequently, the units are designed to be more than a dwelling, and while some scenarios are suggested, the design intends to be an open-end product to be completed by human inhabitation.

At the building scale, human inhabitation connects the structure with the city and facilitates social engagement. The design of the building aims to bring people together, proximity to the ground and visual connections allow people to interact and get to know each other. In this sense, proximity becomes a desirable quality that allows people to not only witness but to participate in the transformation of the building. As a person walks down the stairs to the hair salon in the second floor, he or she can find the new café located on the fifth floor. Maybe as someone walks on the laneway that person can decide to use the ramp cuts through the building and connects to the street to get to their final destination. Also the person that woks on the small industrial space facing the laneway can live on the fourth floor where their partner just opened a yoga studio. These are just some examples of the uses that can coexist within the building generating a close connection between living and working spaces and between people.

Figure 80. Section perspective- view from the street

Figure 81. Section perspective- view from the laneway

Figure 82. Aerial view

Figure 83. Street view

6.5 **Secondary effects**

The placement of a building such as the one designed for this thesis would naturally have an effect on its surroundings. The building designed is located in an area where most of the land is occupied by two stories industrial buildings, therefore, the introduction of a higher density structure will demonstrate the potential of the land in terms of development. Consequently, adjacent lots could start to get developed as well. If the guidelines proposed for this thesis were to be followed, these new developments would:

- Respect existing conditions and uses by either preserving existing buildings or by introducing existing functions into the new structure.
- Preserve lot subdivision which will suggest the use of a building typology with a courtyard, similar to the type used in the design of the buildings for this thesis.
- Achieve high density while responding to the surrounding buildings.
- Introduce the concept of void into the design to ensure access to light and air, engagement with the public realm and elasticity of space.

Following these four simple principles would allow the block and neighborhood to develop by means of fine grain interventions rather than through mega-project. As observed in other areas of the city such as Chinatown, small scale development provides building typologies that have a better connection with the human scale at the same time that it allows for a wider diversity of architectural from. What is more, the restriction of space when buildings on small lots arises the potential to share spaces and services between buildings, for instance, adjacent buildings can share vertical circulation or rooftop garden and by doing so promote social engagement between people. The building designed for this thesis is specifically equipped to connect with adjacent structures and to share components such as elevators, staircases, courtyard and roof gardens. Thus, while promoting individuality and diversity between buildings, each structure also becomes an essential part or a larger system where the interconnection between elements starts to form richer and more adaptable urban environments.

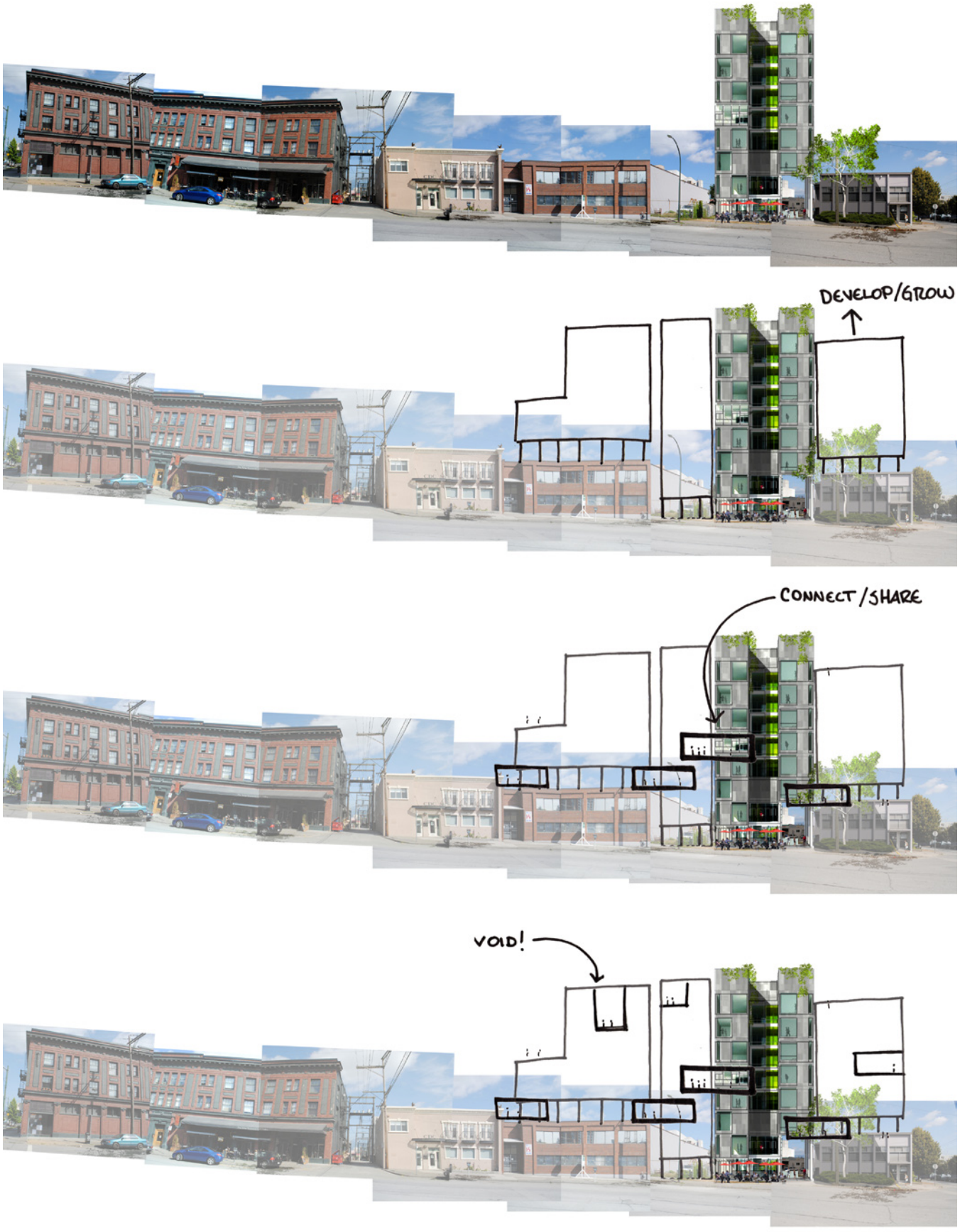


Figure 84. Elevation diagrams about secondary effects.

7. Conclusion

7.1 **Concluding remarks**

After this exploration of urban environments and specifically adaptability, it is evident that dealing with complexity of cities requires collaboration between disciplines. Moreover, architects must acknowledge the important role that each building plays in the construction of the city. Recognizing the dynamic nature of cities and accepting change as a constant variable is essential for the creation of cities that are able to adapt to future needs and transform over time. While some literature and studies exist regarding adaptability of buildings, there is still much to be done to integrate this concept into the urban scale. What is more, adaptability is often simplified and used as a strategy that allows for future growth. In contrast, elasticity refers to the ability of a space to transform, while it also allows recovering to the original state once the force of change is removed. Consequently, elasticity allows for a wider range of transformations at the same time that it encompasses both, temporary and permanent changes.

This research also demonstrates the importance of learning form the existing city. It is evident that many lessons can be taken from everyday life. In order to study and learn from everyday phenomena, it is essential to develop methods of analysis that facilitate such exploration and the subsequent extraction of fundamental principles that can be translated into design strategies. The combination of diverse research and analysis methods proved to be efficient in gathering information from different sources and in various formats, however, the challenge relies in translating the diverse information into a common language that allows comparing and contrasting data. While mapping and diagrammatic techniques were useful to capture and analyze urban and elastic phenomenon, the generation of guidelines and rules facilitated the integration of principles from diverse sources into a general set of parameters. In this sense, the graphic techniques used represent one step in the creation of a framework for design. Thus, if the analysis ends after the generation of maps and diagrams it may be difficult to translate such abstract information into a built form.

Through the analysis or everyday phenomena, it was also possible to identify three essential components of elasticity commonly found in contrasting contexts. Void, edge and flux provided a framework in the generation of analysis methods and later on translated into design strategies. These three elements by being abstract ones, allow for multiple interpretations, however, through the case studies and site analysis it was possible to demonstrate diverse manners in which these elements materialize and are subject to people's manipulation. While edge and flux are essential elements for elasticity, void proved to be the most important one, and to be needed at all scales to ensure future adaptability. In addition, the analysis demonstrated that site analysis is more useful when done in two manners, from the top by gathering data and information available through planning departments, and from the bottom by walking the streets. The study from the top allows identifying larger needs, big forces of change and major concerns; while analyzing the site from the street, it provides an understanding of the life, character and value of the area.

Moving into the design intervention, it became evident that elasticity can and must be incorporated into the design practice in order to ensure adaptability to future needs. The intervention evidenced the important role that buildings play in the creation of the city; buildings are elements that negotiate between the city and the people. Buildings determine the type of connection people has to the ground, their neighborhood, the city and to other people. For this reason the shape, size, layout, structure and materials should respond to both urban and users needs. In other words, the design of buildings must acknowledge the conditions of the site, neighborhood and city,

while also providing adequate spaces to live in. Furthermore, the design intervention demonstrated the importance of designing for elasticity at the small scale in order to ensure that users are empowered to transform their built environment. If elasticity is achieved at small scales, consequently, larger scales will be elastic as well.

Through the exploration of diverse scales, it is possible to tie back the analysis of elasticity to the initial definition of "city" provided for this thesis. The city is a dynamic environment; therefore, elasticity implies potentiating such dynamism by means of the provision of spaces that allow for change as well as by allowing people to participate in urban transformation. The city is also a complex environment, which is why elasticity addresses such complexity by exploring diverse scales and abstracting information that is relevant through scales. In addition, the city is composed by diverse interconnected elements; this aspect is addressed through elasticity by understanding the role that each piece plays in the city as a whole, as well as by designing each element in relation to other components.

As a concluding remark it is possible to say that this research's most important contribution is the identification and combination of methods of study that allow understating, analyzing and designing elastic urban environments.

7.2 **Recommendations**

The research and analysis of elasticity on this thesis provides a wide understanding of the issue of urban adaptability while it also generates a method to study the city from the architectural perspective. As this thesis provides a wide understanding it also opens up many questions regarding the future of cities and the relevance of adaptability and elasticity in the evolution of urban environments. For this reason it is important to present a series of recommendations that can enlarge the knowledge available regarding elasticity. The following, are suggestions that can be followed by future studies and research:

Comparative studies. This thesis compared and contrasted analysis obtained from two different contexts: Mexico City and Vancouver. This technique proved to be useful in facilitating the exchange ideas and to identify fundamental principles which are found on multiple scales and locations. Thus, future studies could focus on the comparison of a specific aspect of elasticity within different cultural, political, social and economical contexts. The comparative study of elasticity on diverse places could allow correlating information to find commonalities and differences while also understanding the role that local conditions play in the manner in which elastic events develop.

Typological Studies. Through the study of typologies for industrial, commercial, office and residential structures it was possible to identify design strategies that facilitate elasticity of buildings. The comparative typological study allowed integrating elastic principles from different building types into one elastic typology. However, there is still opportunities to develop more detailed analysis that can provide more specific information about the manner in which the diverse systems of a building facilitate adaptability and transformation. In addition, future studies could also focus on studying one single building type, providing narrow but detailed information.

Focus on one scale. The study of elasticity for this thesis explored diverse scales ranging from the city to the dwelling unit. While this type of research provides a wide understanding of urban elasticity, the depth of the analysis is limited by its broadness. For this reason, future studies can choose to focus on a single scale and gather more comprehensive information. The study of one scale can facilitate comparative studies between different sites, neighborhoods or cities since the scope of the study is narrower.

Explore implementation into planning tools. This research provides an understating of the problematic of elasticity at the urban scale form the architecture perspective. However as the research's field of study is the city, this research could be subjected to exploration through the lenses of urban planning. It would be interesting to explore the manners in which policy and regulation can facilitate elasticity at diverse scales.

These are the most relevant recommendations identified through the development of this thesis which is considered as one piece of a much larger question that needs to be further developed through future studies, research and practice.

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—. Cities for a Small Planet. London: Faber and Faber, 1997.

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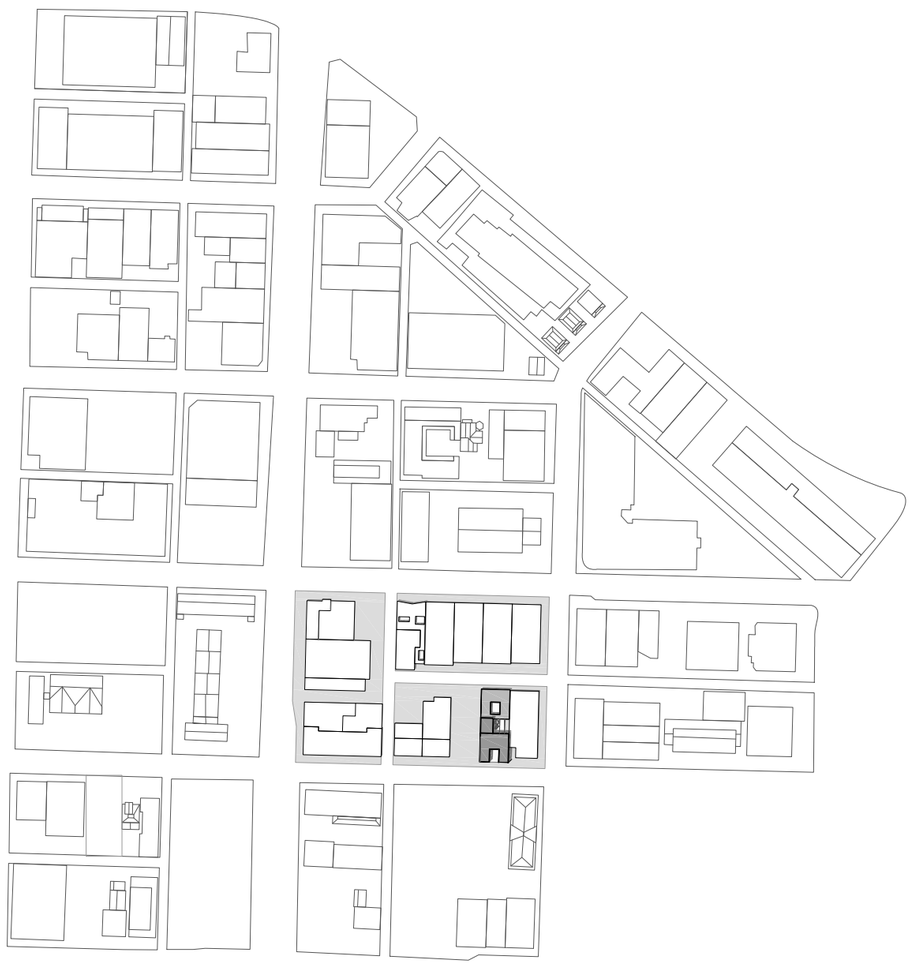
Apendix A- Drawings



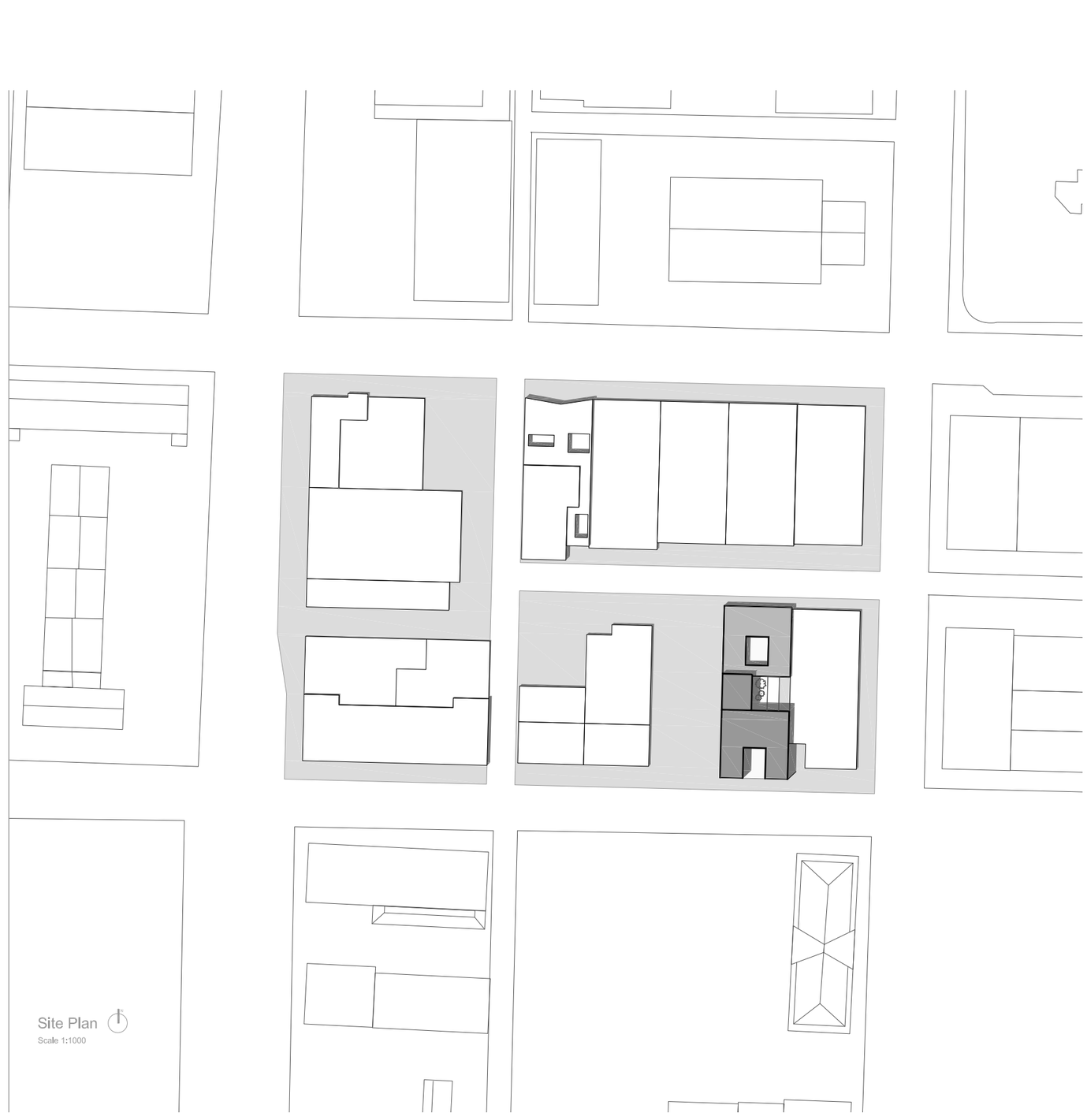
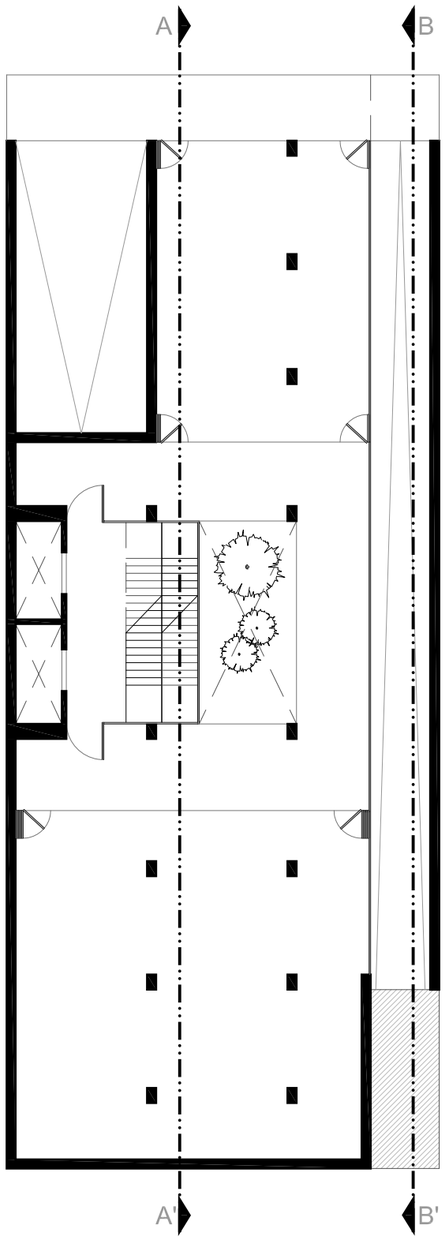
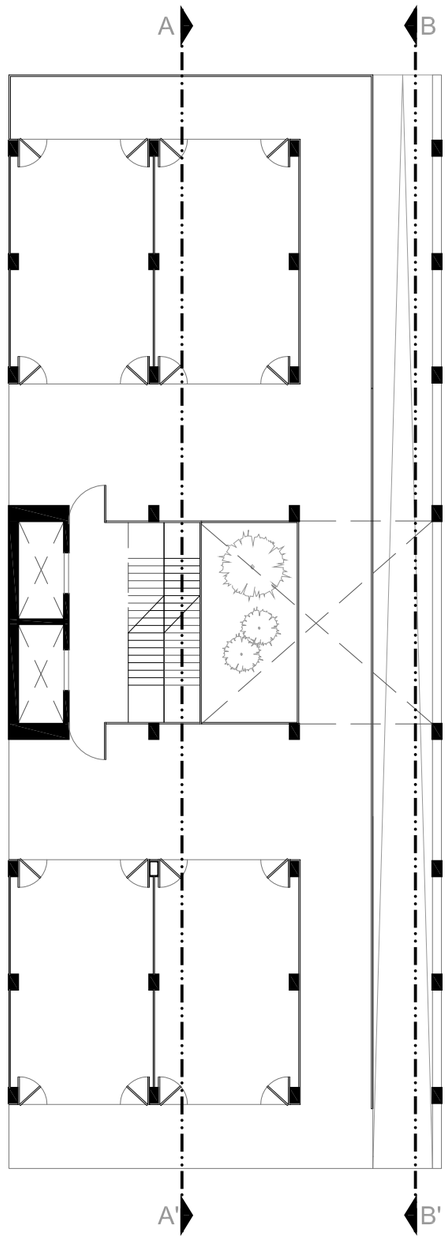


Figure 85. Site Plans



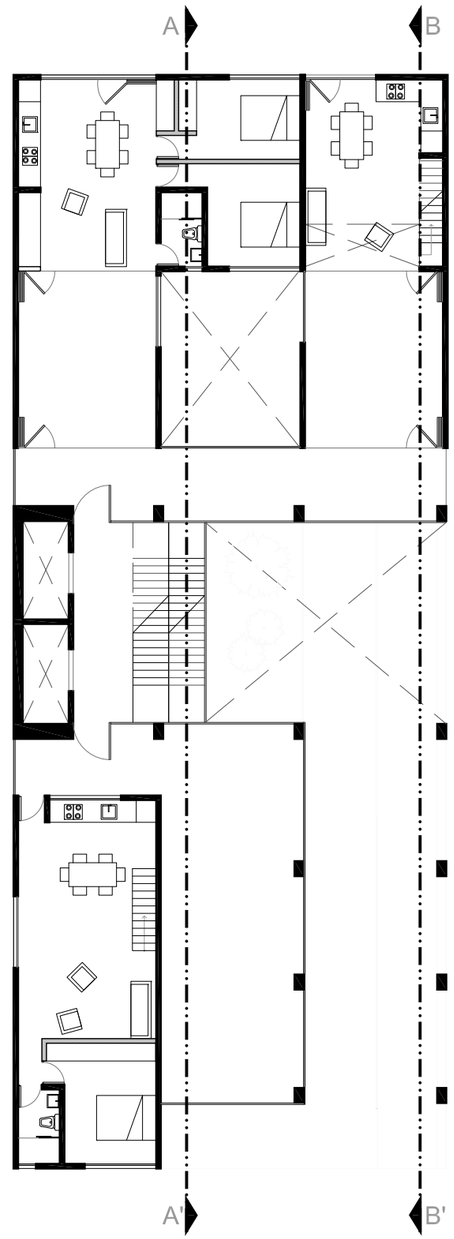
Basement Level

Scale 1:200



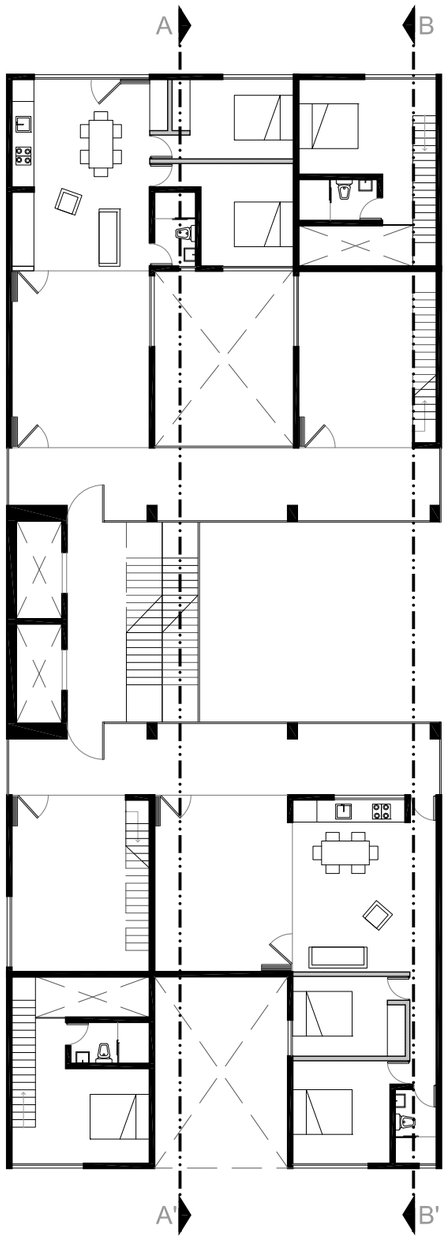
Ground Level

Scale 1:200



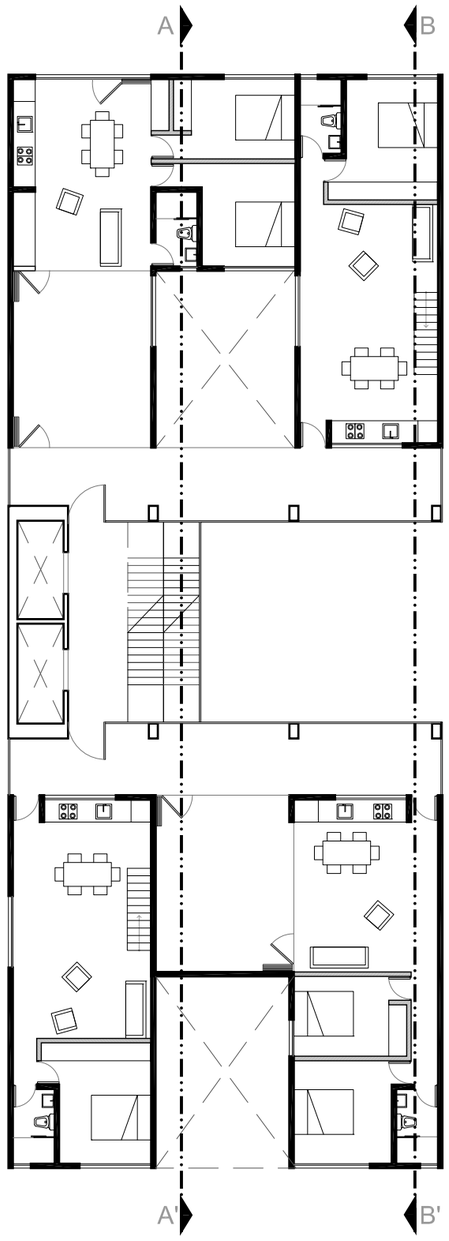
2nd Level

Figure 86.Building Plans



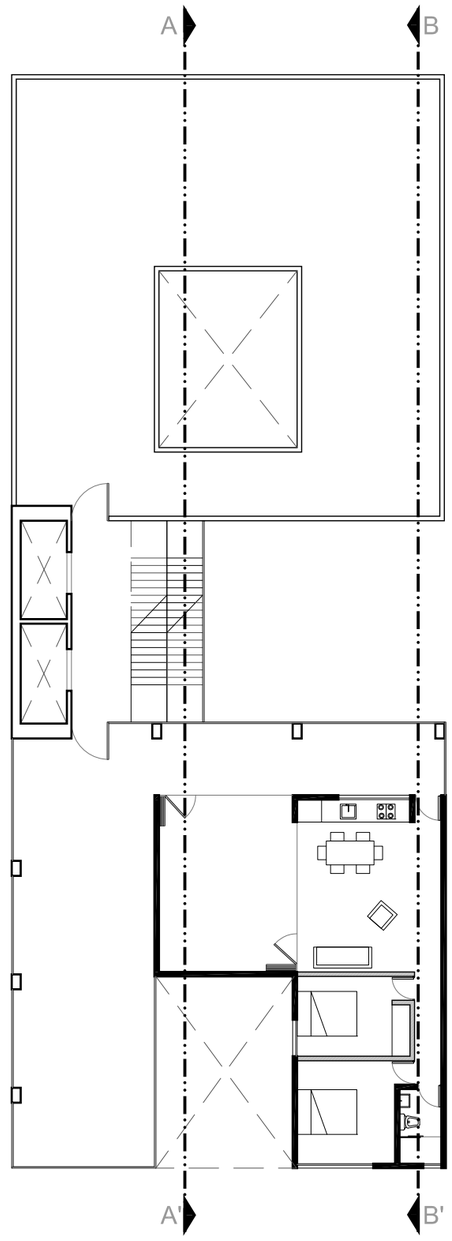
3rd Level

Scale 1:200



4th Level

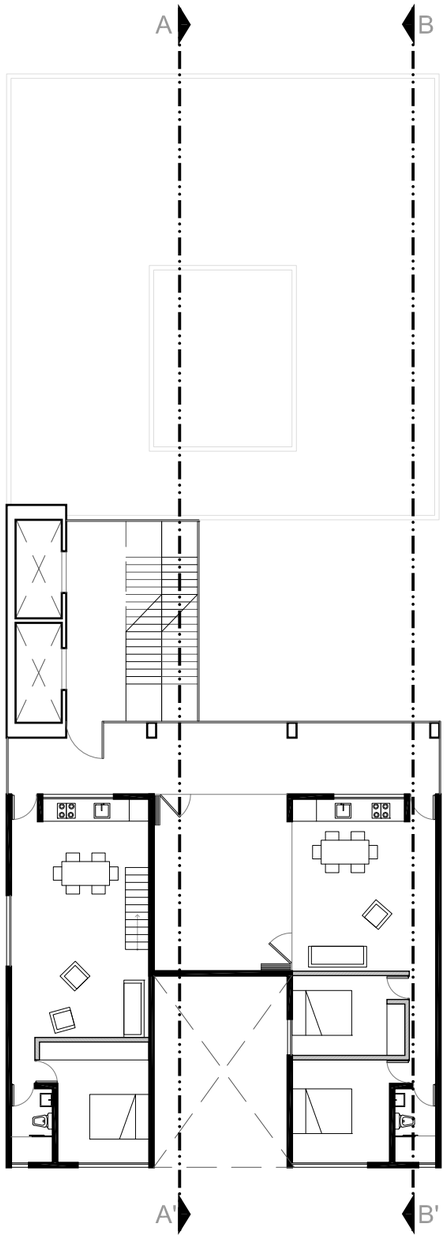
Scale 1:200



5th Level

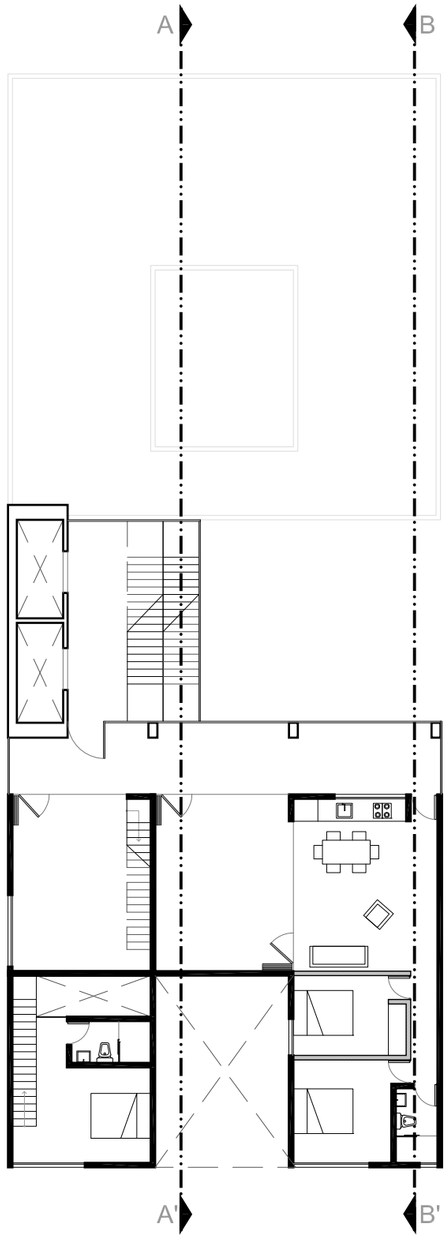
Scale 1:200

Figure 87. Building Plans



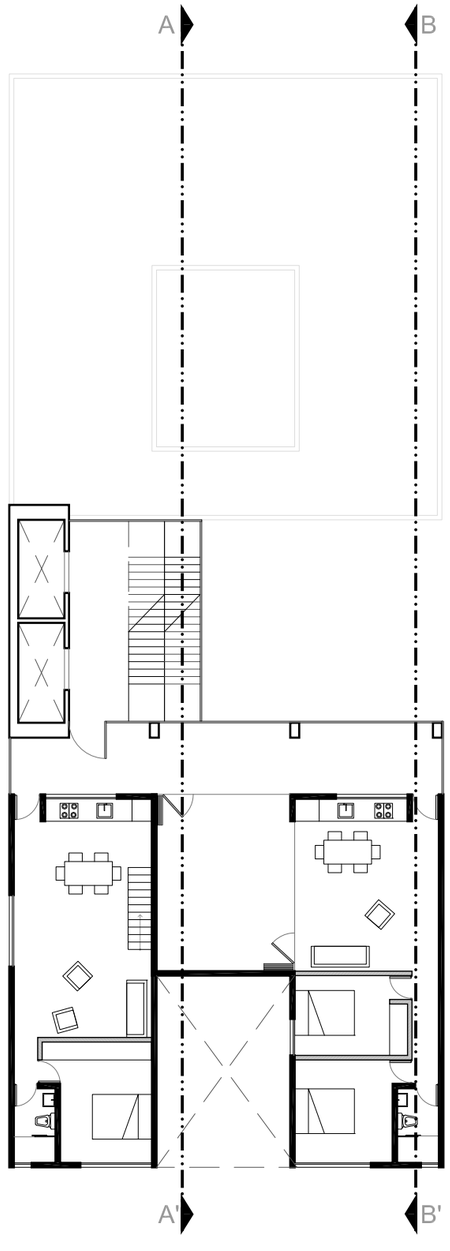
6th Level

Scale 1:200



7th Level

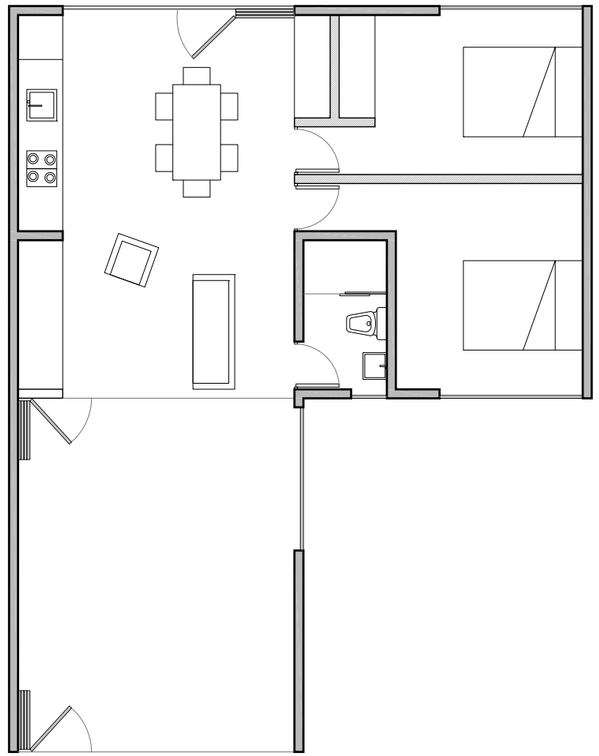
Scale 1:200



8th Level

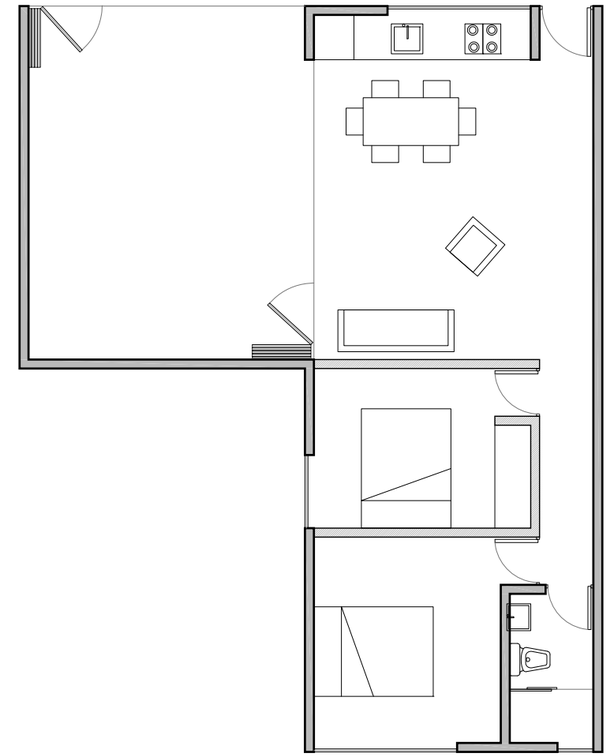
Scale 1:200

Figure 88.Building Plans



Unit A

Scale 1:75

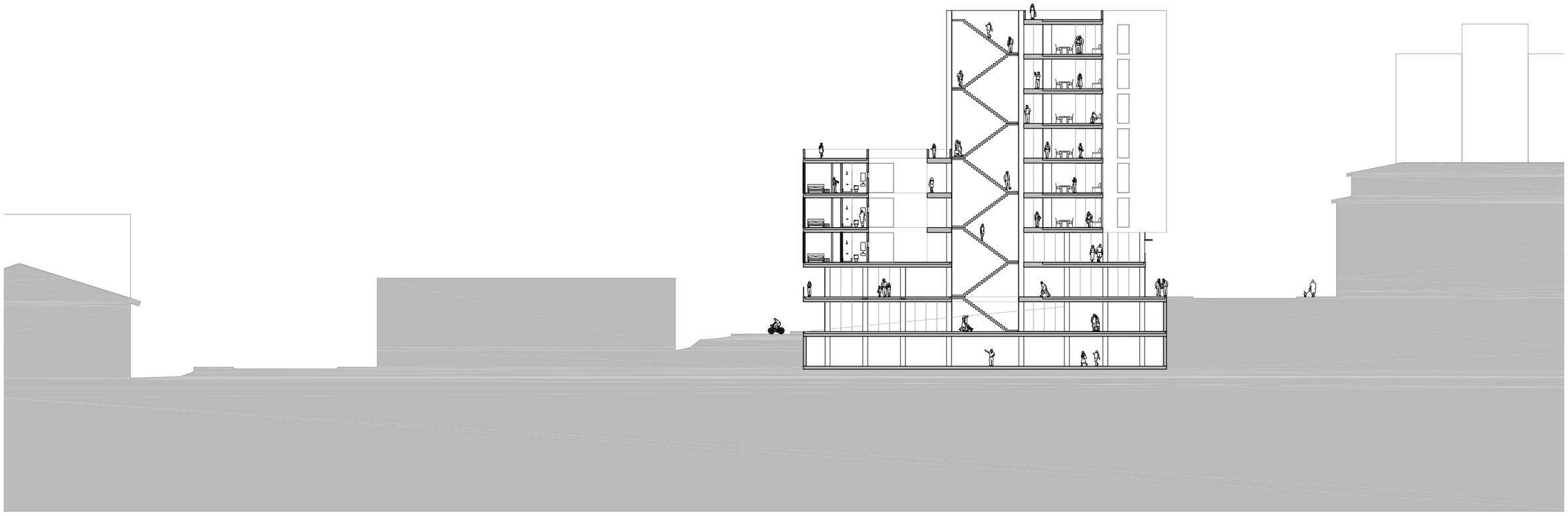


Unit B

Scale 1:75

Figure 89.Units Plans

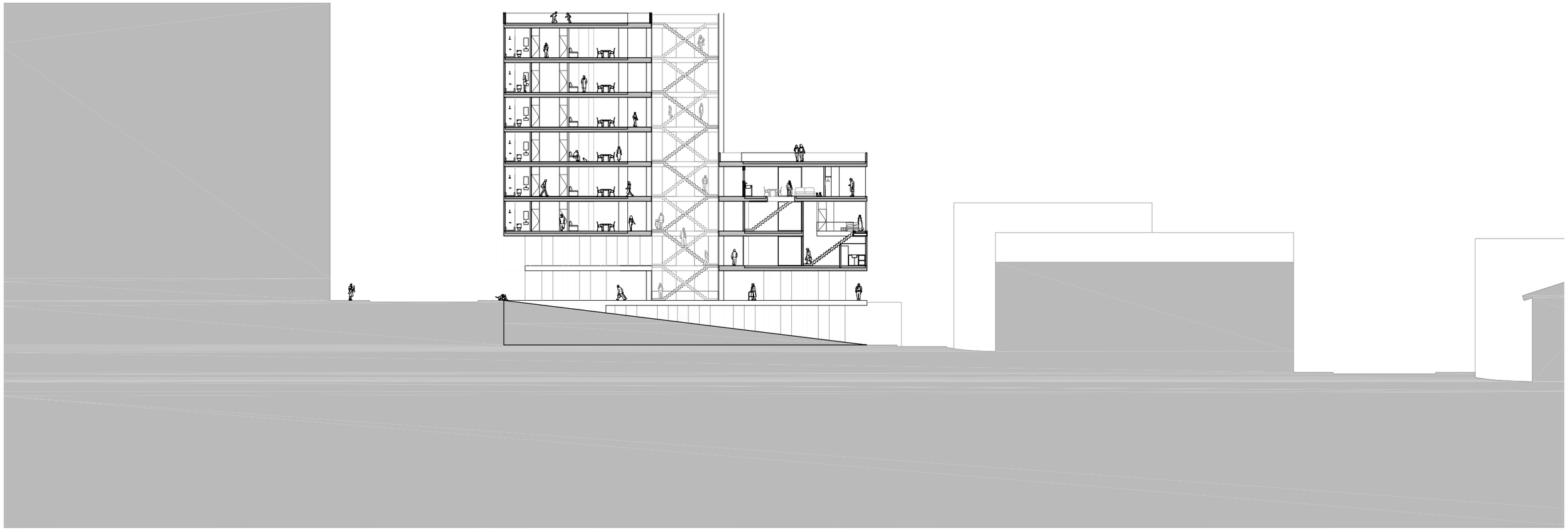
Figure 90.Units Plans



Section A-A'

Scale 1:400

Figure 91.Building Section



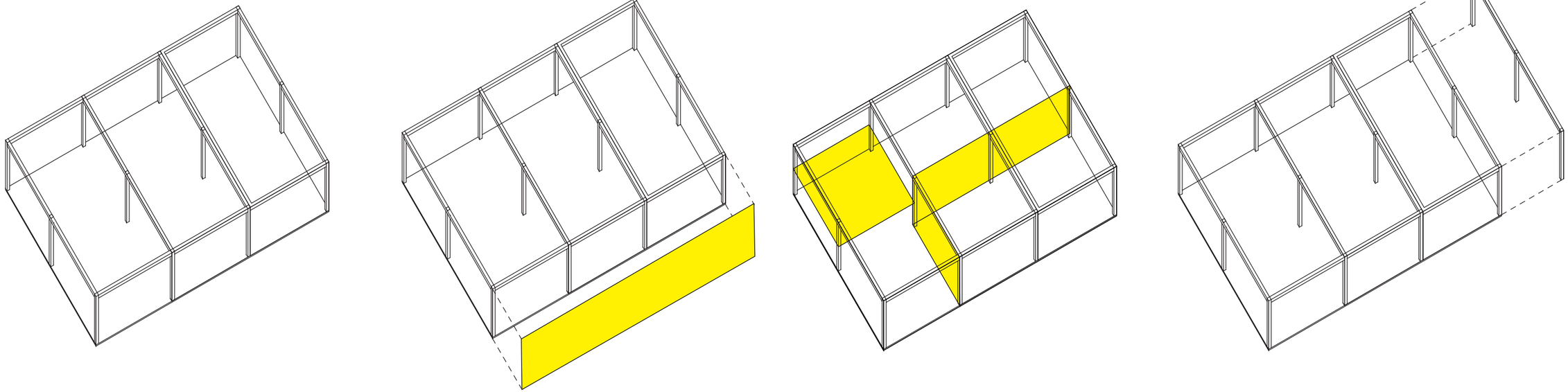
Section B-B'

Scale 1:400

Figure 92.Building Section

Apendix B- Additional analyses

Industrial Structures



1 Perimetral structure and high ceilings allow for big open spaces.

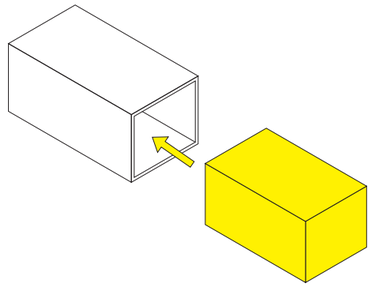
2 Skin separated from structure, therefore it can be easily modi-fied.

3 Space and be easily subdivided horizonal and vertically. This subdivision can be permanent or temporary depending on their structure and materials

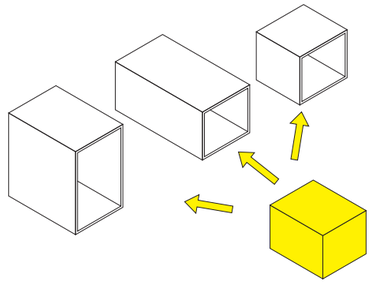
4 The building can easily extend by adding structural frames.

Figure 93. Study of elastic properties of industrial spaces

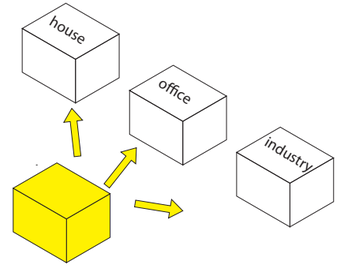
Commercial



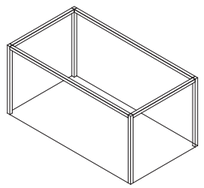
1 Commercial structures act as shells that can be esily cutomized.



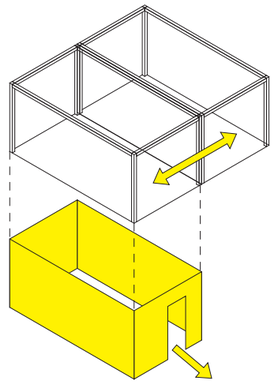
2 Commercial uses can fit into shells with diverse forms and sizes depending on the type and sclae of the commerce.



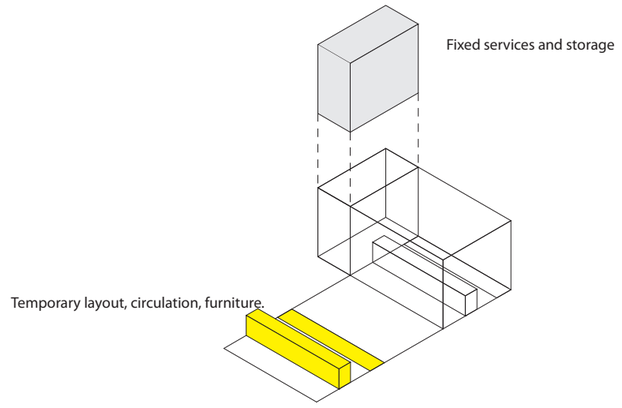
3 Commercial uses act as free radicals and can be asily be attached to other uses/structures such as dwellings, offices, indutry.



4 Commercial uses can benefit from perimetral structure and high ceilings that allows for big and open spaces.



5 Separation of skin and structure can allow commercial uses to extend to adjacent spaces. In addition a porpus facade allows the activity to permate into public space.



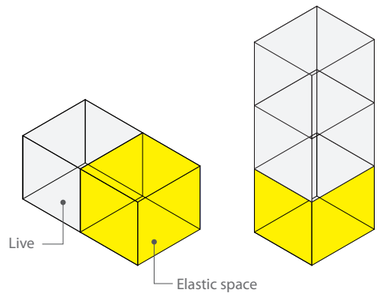
3 Commercial uses are formed by 2 types of components: fixed and temporary. Services and storage spaces tend to be fixed. On the other hand the layout of the area accesible to the public is more temporary since circulation, layout, and furniture are easier to rearrange

Figure 94. Study of elastic properties of commercial spaces

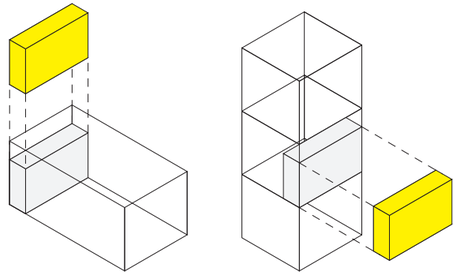
Residential

Stairs:
Use enbodied energey, and allow future aditions in height. Diverse uses could be placed in the different leevels, however, idustrial activities or workshops would work better on the ground floor

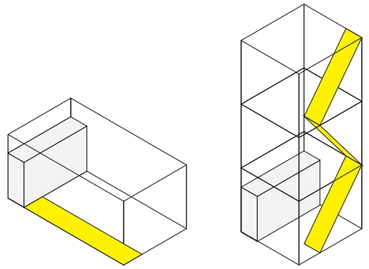
Elevator:
Require electricity to work and the number of stories is fixed. However elevators allow industrial activities and small workshops to be placed on upper levels.



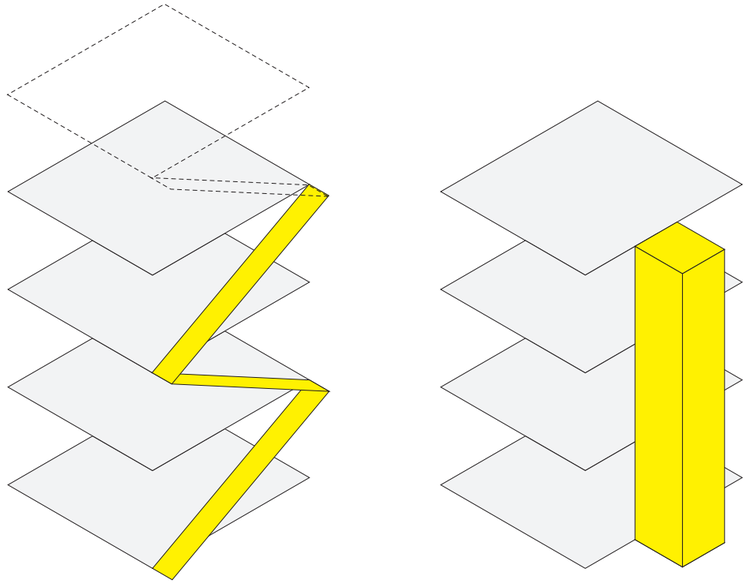
1 Generate a clear demarcation between Living and Elastic space.



2 A compact service block allows to have more free open space in the dwelling.



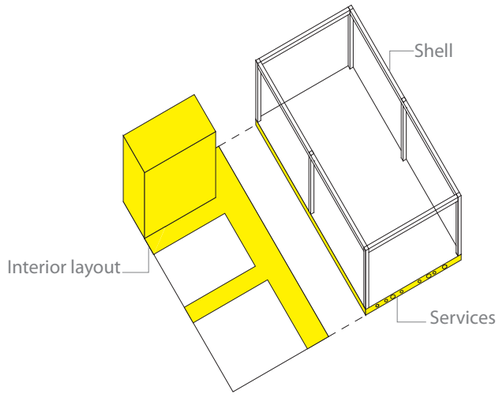
3 The location of the service block and circulation will have a strong effect on the arrange of other living spaces as well as on the Elasti-city of the dwelling.



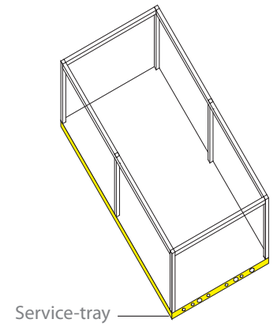
4 On the building scale, location of services and the types of vertical circulation selected, impacts the types of uses a building can host and the Elasti-city of the residential structure.
In both examples industry, commerical activities, workshops and offices should be located close to vertical circulation which provide ease of acces and poteentialy allows the separation of public and private spaces.

Figure 95. Study of elastic properties of residential spaces

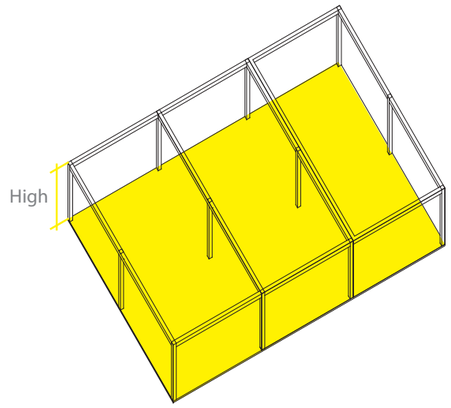
Office



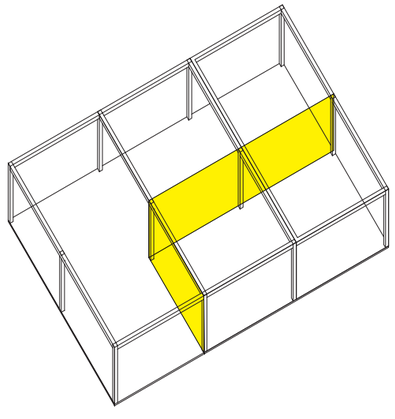
1 Office buildings are composed by 3 elements: shell, services and interior layout (Neufert, 225). Shells are fixed but flexible, services should be easy to acces, modify and update while the interior layout is continously changing.



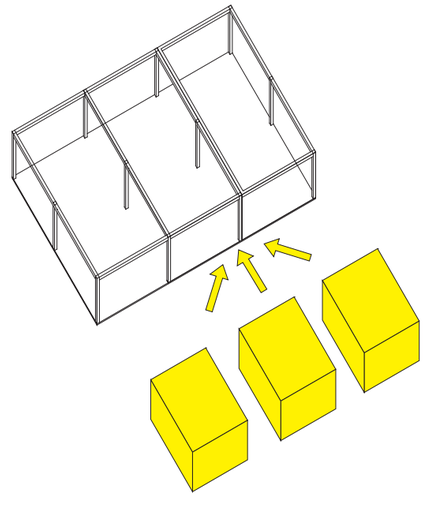
2 Services are easier to acced and update when located on a service-tray on the goud or ceiling.



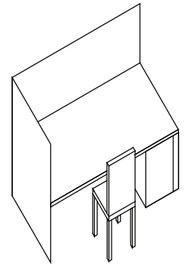
3 Office spaces can benefit from perimetral structure and high ceilings that allows for big and open spaces.



4 Office spaces are easyily subdivided and modified.



5 Office spaces can be easily modifies to host other activities such as commericla and residential.



3 Office spaces are modular based on the dimensions the workspace of one person.

Figure 96. Study of elastic properties of office spaces

Use requirements

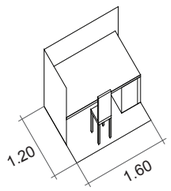
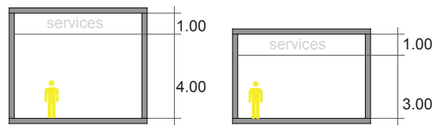
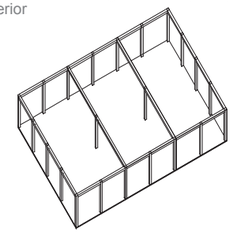
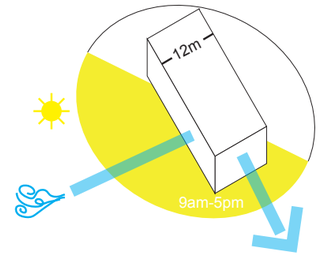
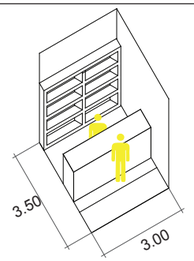
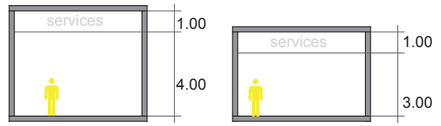
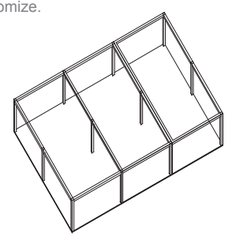
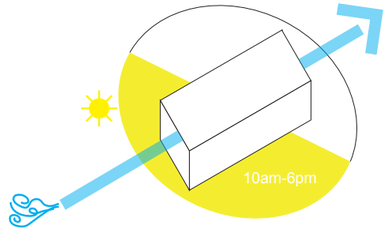
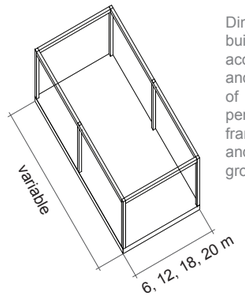
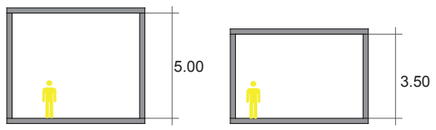
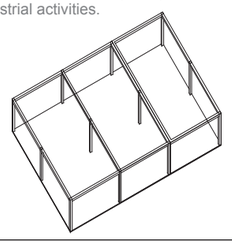
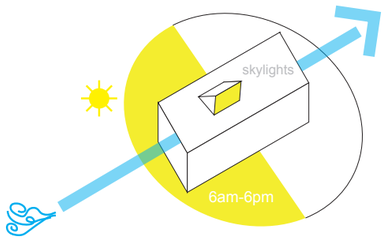
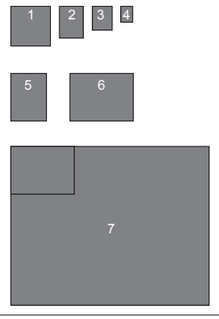
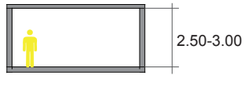
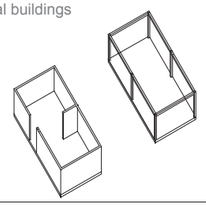
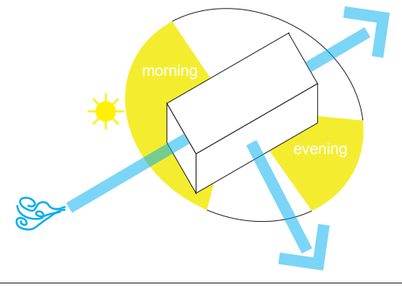
	Area/Module	Height	Structure	Light/Air/Orientation
Office	 Office space can be calculated by person/workspace, 15% for circulation and addign modules for other spaces such as meeting rooms.		Exterior structural grid allows to subdivde spaces while having as much open space in the interior 	 Shallow spaces allow for natural light and cross ventilation. As office buildings are generally in use from 9am-5pm orientation must allow for the building to be illumintated duting these hours.
Commercial	 Commercial spaces tend to have be 3.5 meters wide by 3.0 meter long. The length often varies.		A structural frame can provide big open spaces that at the same time are easy to subdivide and customize. 	 Commercial spaces cluld benefit from cross ventilation. In addition, natural light can help reduce reliance on artificial illumination. However direct sun irrandiance and heat gain can be negative during heat season or when mechandise needs to be protected, shadding devices can help control these aspects.
Industrial	 Dimensions of Industrial buildings change accoridng to lot size andspace requirements of the activity to be perfonmed. Structural frames provide flexibility and allow the building to grow or contract.		A structural frame can also allow for future additions to industrial buildings at the same time that it provides open spaces necesary for industrial activities. 	 Cross ventilation is essential for industrial buildings when the temperatures allow for natural systems. Natural illumination is always beneficial and can be achieved though skylights when there are adjacent buildings that reduce sun licht exposure.
Residential	 1)Eat-Cook-Live 25m2 2)Sleep A 12m2 3)Sleep B 7.5m2 4)Bathe 3m2 5)Live 29.7m2 6)Live/Work 47m2 7)Live/Artist 47+500m2		The structure for residential buildings tends to be very fixed where walls are sructural and therefore can not be moved or modified. For this reson residential buildings could benefit from flexible structures simmilar to the ones of industrial buildings 	 Redicential uses contain spaces with different requirements according to the time od day ther are used, bedrooms can benefit from morning sun, while other spaces would work bes with evening sun light. Everyliving space requires natural light and ventilation provided preferably by a window.

Figure 97. Study of diverse use requirements

Use adjacency Study

all uses

office

commercial

industrial

residential

Possible Adjacencies

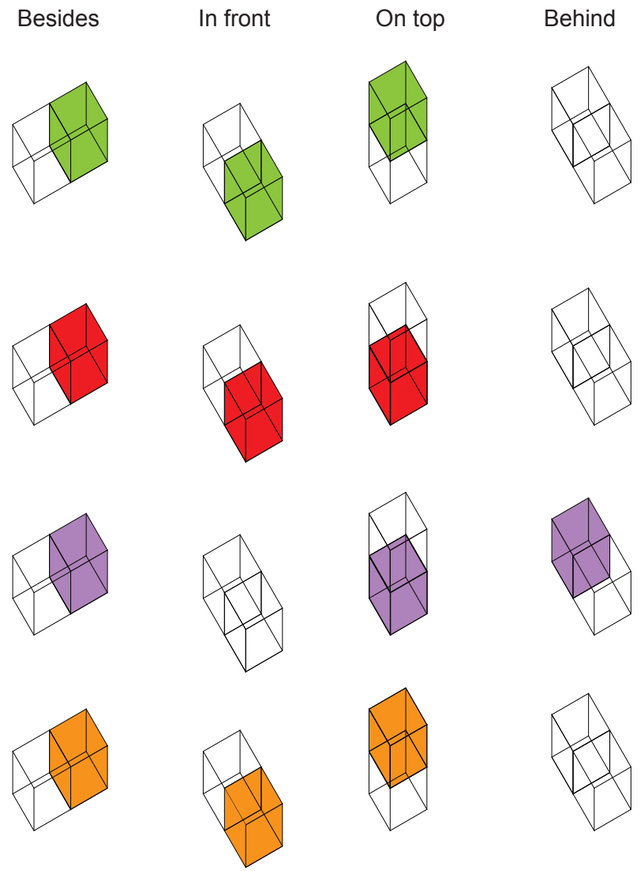
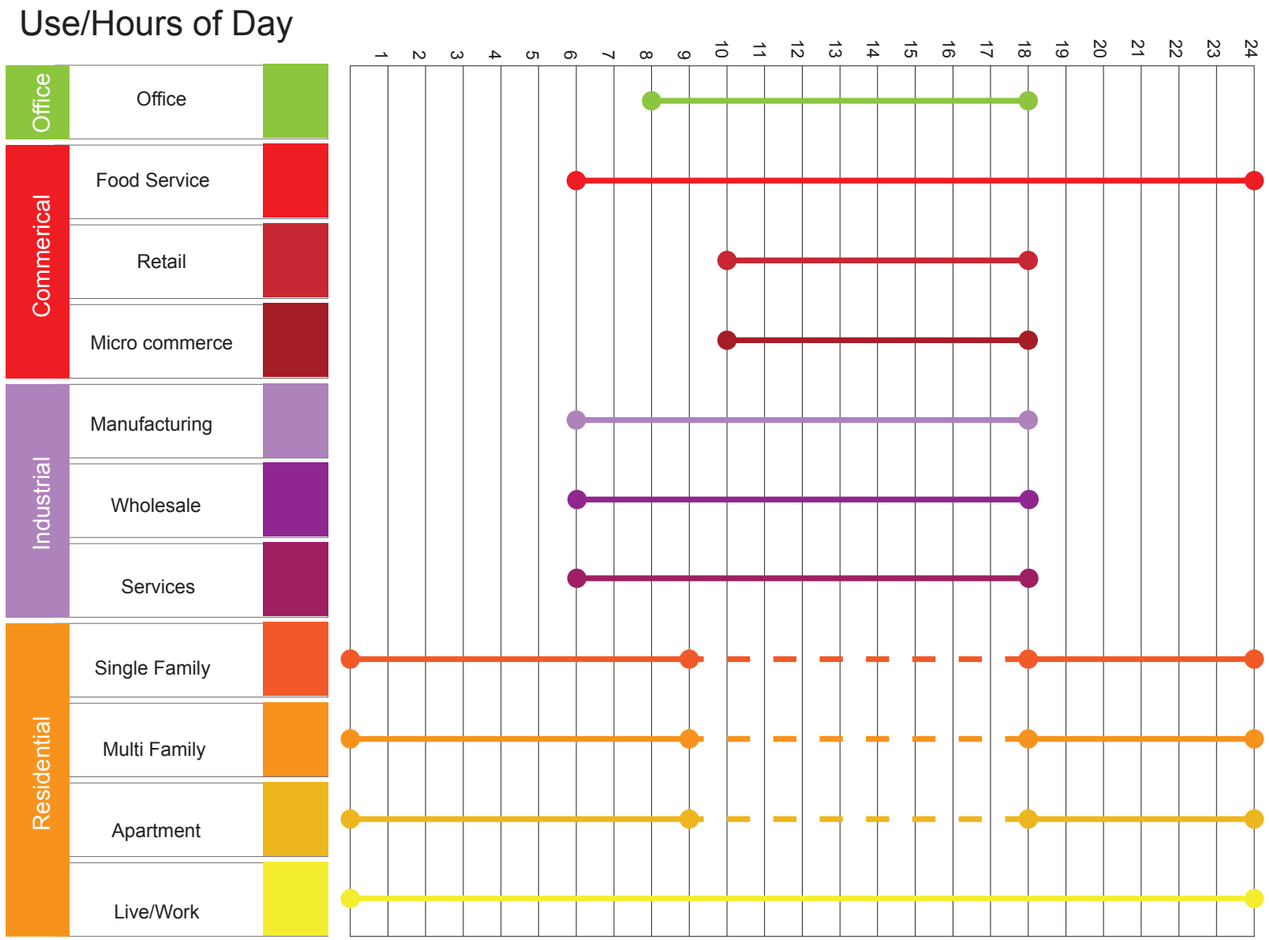


Figure 98. Study of uses adjacencies and compatibility

Use adjacency Study







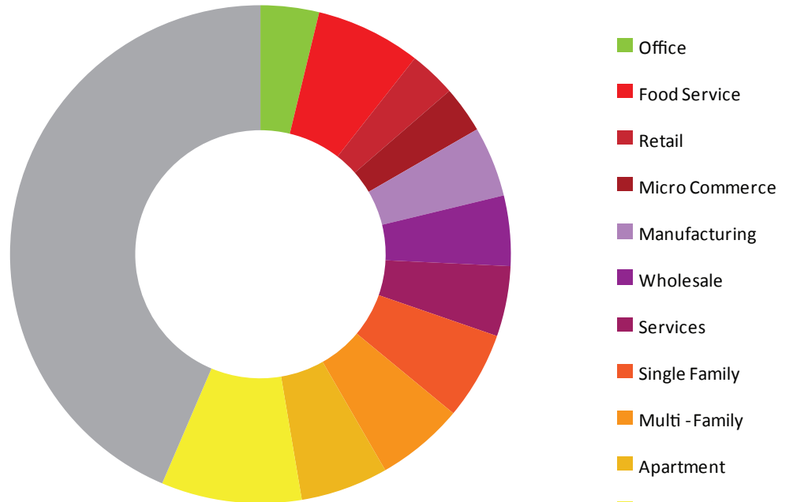


Figure 99. Study of uses adjacencies and compatibility