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Master's Degree Thesis

# Title : Self-sufficient Neighborhood and Mixed-use Building Design

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# Self-sufficient Neighborhood
# and
# Mixed-use Building Design

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*I would like to express my deepest gratitude to the exceptional individuals who have illuminated the path of my master's thesis journey through their support and boundless encouragement.  I am profoundly grateful for your presence in my life.*

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*And For  "Woman, Life, Freedom..."*

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## Abstract

This thesis explores the integration of self-sufficient neighborhoods with mixed-use architecture as a strategy to foster sustainable urban development. With the increasing challenges of population growth, resource scarcity, and environmental degradation, innovative approaches to urban design become essential. This study investigates the potential of self-sufficient neighborhoods, which generate and manage energy, water, food, waste, and transportation systems, with the aim of creating resilient and livable urban environments.
Mixed-use buildings play a significant role in self-sufficient neighborhoods by integrating diverse functions and activities within a single structure. They optimize land utilization, stimulate local economies, foster social interactions, and can incorporate sustainable features. By combining these elements, mixed-use buildings contribute to the development of environmentally sustainable, economically vibrant, and socially cohesive neighborhoods.
This thesis places emphasis on the practical application of theoretical knowledge by undertaking a design proposal for the Spina 3 neighborhood in the city of Turin. The area is located over Porta Susa Spina 2, between Corso Principe Oddone, Piazza Baldissera, Corso Vigevano, and Corso Umbria. The PRIU (Programmi di riqualificazione urbana) programs aim to encourage mixed public-private interventions for non-residential and residential building improvements, while the PRUSST (Programmi di riqualificazione urbana e di sviluppo sostenibile del territorio) programs promote sustainable economic, environmental, and social development. The Spina 3 plan, initiated by the Municipal Administration and various companies, aims to revitalize the former industrial area and surrounding neighborhoods. Significant economic resources, both from the Italian government and the European Union, have been allocated for this purpose. The plan has generated high expectations among both old and new residents, who hope it will address the chronic lack of public services in the suburbs. The initial plans included large, tall buildings, a new Catholic cathedral, and several supermarkets, but there was a lack of new public buildings. As the population increases, there is a growing need to address their needs, such as constructing public schools, improving transportation, establishing sports facilities, setting up a post office, and creating meeting and cultural centers for people of all ages. These infrastructure developments are crucial to accommodate the evolving requirements of the community.
This thesis provides valuable insights into the concept of self-sufficient neighborhoods and their integration with mixed-use architecture. The research findings enhance the knowledge base of sustainable urban design by proposing a master plan design that focuses on creating a green corridor to connect and enhance existing green spaces within the site. The plan also emphasizes improving pedestrian and bike paths, creating gathering areas to foster social interactions at the neighborhood level, and designing a multi-functional building to address the various needs of the residents. These practical recommendations aim to facilitate the development of a resilient and livable community.

Keywords: self-sufficient neighborhoods, mixed-use architecture, sustainable urban design, case study analysis, resource efficiency, community engagement.

## Methodology

With a case study approach, this research examines several projects known for their self-sufficiency and mixed-use features in various scales, ranging from a city to a small apartment, including the “Melbourne 2030” initiative. “Melbourne 2030” serves as a notable example of a self-sufficiency project at the city scale. The “Melbourne 2030” initiative proposes a comprehensive 10-step plan to transition the city from being a consumer of resources to becoming a zero-carbon urban environment. The plan focuses on key initiatives such as electrifying transport, sustainable energy production, waste recycling, and efficient architecture. Specific measures include phasing out electric combustion engines in cars, eliminating natural gas for heating, retrofitting existing buildings to reduce energy and water consumption, converting organic waste to energy, and mandating net-positive energy, water neutrality, and zero-waste for new buildings.
Through site observations and data analysis, the study identifies key elements contributing to their sustainability and assesses their effectiveness in achieving self-sufficiency goals.

## The Aim of the thesis

The result of this thesis is a valuable contribution to the knowledge base of sustainable urban design it offers insights into the concept of self-sufficient neighborhoods and their integration with mixed-use architecture the design proposal for the Spina 3 neighborhood provides practical recommendations for creating a resilient and livable community taking into account the specific context and challenges of the area by considering sustainability principles and leveraging existing potentials the thesis aims to foster sustainable urban development and enhance the quality of life in the neighborhood. When implementing self-sufficiency criteria in an existing neighborhood, it is crucial to consider and implement strategies based on the existing potentials and constraints of the neighborhood. Unlike designing a new neighborhood from scratch, working with an existing neighborhood requires a thoughtful and adaptive approach to leverage its unique characteristics and address its specific challenges. Assessing available resources, analyzing the existing building stock, and introducing mixed-use buildings are essential steps in this process.

Chapter One

# Introduction

*Illustrations: Ana María Ospina*

## Background and context of the study

The value of self-sufficiency in the scale of neighborhoods is more evident in the post-COVID era. The COVID-19 pandemic has highlighted the vulnerabilities and challenges faced by communities, and building self-sufficient neighborhoods can help address these issues effectively.
The importance of redesigning living spaces and ensuring adequate resources and support for vulnerable populations, such as migrant workers, seniors, and students from disadvantaged backgrounds, lies in enabling individuals to age gracefully, access online learning, and cope with public health emergencies. These measures aim to provide a supportive and resilient environment for residents, and self-sufficient neighborhoods can play a role in achieving this objective.
In addition to improving the physical aspects of living spaces, providing adequate resources and support is crucial. This can involve ensuring access to essential amenities, healthcare services, and social support networks. For example, creating self-sufficient neighborhoods with green spaces and promoting a biophilic design can contribute to a more sustainable and balanced environment.

Amidst the challenges posed by the pandemic and the limitations on mobility, the concept of a self-reliant and compact urban setting, reachable within a 15-minute radius, emerges as a potentially effective model for curbing virus transmission. This stems from the fact that within this radius, all inhabitants can conveniently access their diverse necessities—ranging from professional commitments and education to shopping, healthcare, recreation, and cultural experiences—without the need to traverse the entire city. For this model to thrive, however, it hinges on the imperative of uniformly distributing indispensable services, roadways, and communal areas. This equitable allocation ensures that essential resources are accessible to all residents, regardless of their geographic location within the city. Such an approach not only facilitates daily activities but also contributes to building a resilient and sustainable urban landscape.

The relation between self-sufficient neighborhoods and green architecture is that self-sufficient neighborhoods often incorporate principles of green architecture to achieve sustainability and reduce environmental impact. Green architecture, also known as sustainable architecture or eco-friendly architecture, focuses on designing buildings and communities that minimize resource consumption, reduce waste, and enhance the well-being of occupants.
Green architecture contributes to sustainable development in several ways.
Firstly, it helps reduce pollution and prevent environmental degradation by incorporating features such as energy-efficient lighting and appliances, water-saving plumbing fixtures, and alternate power sources like solar or wind power. This reduces the overall environmental impact of buildings and promotes a healthier and cleaner environment.
Secondly, green architecture helps conserve natural resources by using non-synthetic, non-toxic materials and locally-obtained woods and stone. By minimizing the use of non-renewable resources and promoting responsible harvesting practices, the green architecture supports the long-term availability of resources for future generations.
Thirdly, green architecture improves energy efficiency, which has economic and environmental benefits. It reduces the amount of money spent on water and energy by the building's operators. This not only saves costs but also reduces the demand for energy and water resources, leading to more sustainable use of these resources.
By considering the social aspect of sustainability, green architecture enhances the well-being of occupants and promotes a sense of community and harmony with the surrounding environment.
Overall, green architecture plays a crucial role in sustainable development by addressing environmental, economic, and social aspects, and striving to create buildings that are environmentally responsible, resource-efficient, and socially beneficial.

Green architecture defines an understanding of environment-friendly architecture under all classifications and contains some
universal consent (Burcu, 2015), It may have many of these characteris-

tics:

- Ventilation systems designed for efficient heating and cooling
- Energy-efficient lighting and appliances
- Water-saving plumbing fixtures
- Landscapes planned to maximize passive solar energy
- Minimal harm to the natural habitat
- Alternate power sources such as solar power or wind power
- Non-synthetic, non-toxic materials
- Locally-obtained wood and stone
- Responsibly-harvested woods
- Adaptive reuse of older buildings
- Use of recycled architectural salvage
- efficient use of space

While most green buildings do not have all of these features, the highest goal of green architecture is to be fully sustainable.
Also Known as Sustainable development, eco-design, eco-friendly architecture, earth-friendly architecture, environmental
architecture, natural architecture (USGBC, 2002).

## Significance of the Study and Importance for the Future

This thesis explores the integration of self-sufficient neighborhoods with mixed-use architecture as a strategy to foster sustainable urban development. The study addresses the increasing challenges posed by population growth, resource scarcity, and environmental degradation, which demand innovative approaches to urban design. By investigating self-sufficient neighborhoods that generate and manage energy, water, food, waste, and transportation systems, the research aims to create resilient and livable urban environments.

The significance of this study for the future is multifaceted:

1. Addressing Climate Change and Resilience: As cities face the impacts of climate change, the concept of self-sufficient neighborhoods with mixed-use architecture can serve as a model for climate-resilient urban development. By integrating sustainable practices, such as renewable energy generation, efficient resource management, and green infrastructure, these neighborhoods can become more adaptable and better equipped to withstand the challenges posed by a changing climate.

2. Sustainable Urban Growth: With urbanization on the rise and an increasing global population concentrated in cities, the development of self-sufficient neighborhoods can promote sustainable urban growth. By providing a blueprint for resource-efficient, multi-functional, and socially inclusive communities, this study offers a pathway to accommodate future urban expansion while minimizing the strain on resources and preserving natural ecosystems.

3. Resource Conservation and Circular Economy: Self-sufficient neighborhoods emphasize resource autonomy, reducing the dependence on external resources and promoting circular economy principles. By efficiently managing energy, water, waste, and food locally, these neighborhoods can contribute to reduced resource consumption, waste generation, and greenhouse gas emissions, thereby fostering a more sustainable and circular urban environment.

4. Social Cohesion and Well-Being: Mixed-use architecture within self-sufficient neighborhoods promotes social interactions, community engagement, and a sense of belonging among residents. These elements contribute to increased social cohesion and well-being, fostering a supportive and thriving urban community that enhances the overall quality of life for its inhabitants.

5. Economic Opportunities: The integration of mixed-use buildings can stimulate local economies by creating diverse employment opportunities, supporting small businesses, and attracting investments. Addition-

ally, sustainable urban development can lead to cost savings in the long term, as self-sufficient neighborhoods reduce reliance on external resources and minimize operational expenses.

6. Policy and Planning Implications: The findings and recommendations of this study can inform urban planning policies and development guidelines, serving as a reference for decision-makers and city officials. It can influence policy development towards more sustainable, resilient, and people-centric urban planning, fostering a more sustainable and equitable future for cities.

7. Global Relevance: The concepts explored in this study are applicable not only to the specific case study in Turin but also have broader relevance on a global scale. As cities worldwide grapple with similar challenges related to urbanization, resource management, and climate change, the insights from this study can inspire and inform sustainable urban development practices in various contexts.

In conclusion, this study's importance for the future lies in its potential to shape sustainable urban development practices, mitigate climate change impacts, foster resilient and inclusive communities, and provide a blueprint for resource-efficient and socially cohesive neighborhoods. By offering innovative solutions to pressing urban challenges, this research contributes to building a more sustainable and livable future for cities around the world.

## Research questions and objectives

## Research Questions:

1. What are the key characteristics and principles of self-sufficient neighborhoods, and how can they be integrated with mixed-use architecture to foster sustainable urban development?

2. How can mixed-use buildings within self-sufficient neighborhoods optimize land utilization, stimulate local economies, and foster social interactions while incorporating sustainable features?

3. What are the specific challenges and opportunities in designing and implementing self-sufficient neighborhoods with mixed-use architecture, considering factors such as resource efficiency and community engagement?

4. How can the design and layout of compact mixed-use buildings enhance community interactions, promote social cohesion, and create inclusive public spaces that cater to the diverse needs of residents in self-sufficient neighborhoods?

5. How can the practical application of theoretical knowledge be effectively realized through a design proposal for the Spina 3 neighborhood in Turin, considering the area's urban regeneration programs and sustainable development initiatives?

Objectives:
1. To examine and analyze existing literature and case studies related to self-sufficient neighborhoods, mixed-use architecture, and sustainable urban development, in order to establish a comprehensive understanding of the subject.
2. To identify and explore the potential benefits and challenges associated with integrating self-sufficient neighborhoods with mixed-use architecture, considering environmental, social, and economic factors.

3. To assess the practical application of theoretical knowledge by developing a master plan design proposal for the Spina 3 neighborhood in Turin, focusing on creating a green corridor, enhancing existing green spaces, and improving pedestrian and bike paths.

4. To investigate the role of mixed-use buildings in self-sufficient neighborhoods, with a specific emphasis on optimizing resource efficiency, promoting community engagement, and fostering social interactions.
To evaluate the potential of self-sufficient neighborhoods with mixed-use architecture as a strategy for addressing urban challenges, such as climate change impacts, resource scarcity, and social cohesion, and their significance for future urban development.

5. To contribute to the knowledge base of sustainable urban design by offering valuable insights and design principles that can be applicable not only to the Spina 3 neighborhood but also to other urban contexts facing similar challenges.

By addressing these research questions and achieving the specified objectives, this study aims to provide a comprehensive understanding of self-sufficient neighborhoods with mixed-use architecture and their significance for promoting sustainable urban development, offering practical recommendations for the creation of resilient and livable communities in the future.

# The Framwork

## Project's Outline

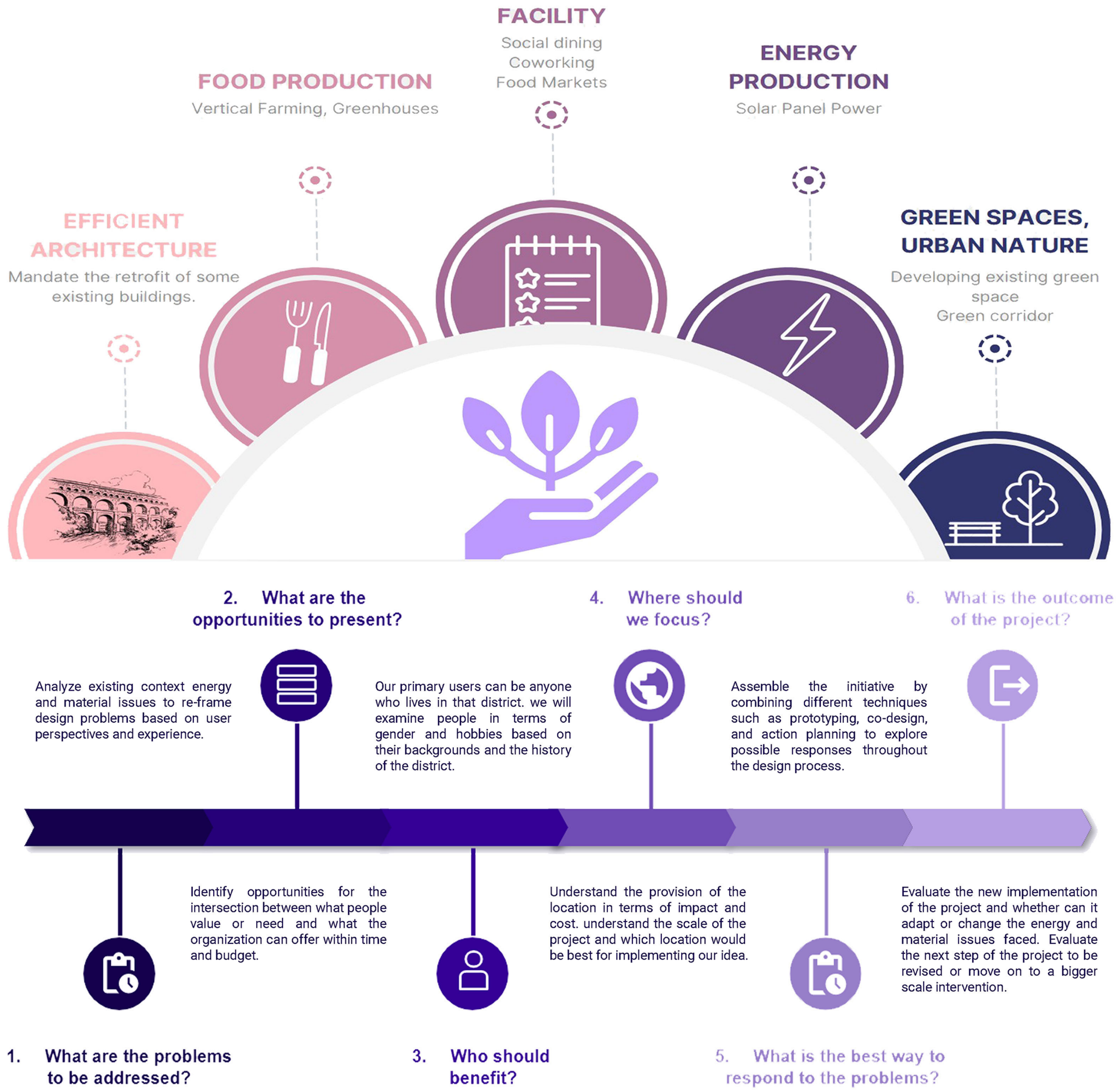



*Figure 1: The framework diagram*
*Reference: Author*

## Important references on the subject

In the realm of self-sufficient neighborhood and mixed-use building design, several noteworthy references have contributed to the depth of understanding in this field. Among them are the following key references:

1. “Self-Sufficient Community through the Concepts of Collective Living and Universal Housing”
This work, which delves into the principles of Universal Housing Design and collective living strategies, holds significance as it highlights the alignment of diverse needs and abilities over time. The paper emphasizes the role of such principles in achieving self-sufficiency within communities.

In-text Citation: (“Self-Sufficient Community through the Concepts of Collective Living and Universal Housing,” n.d.)

Full Reference:
Self-Sufficient Community through the Concepts of Collective Living and Universal Housing. (n.d.).

2. “Characterising the Development Trends Driving Sustainable Neighborhoods”
This study, focusing on sustainable neighborhoods, offers insights into the crucial components of mixed-use buildings, housing diversity, food security, and self-sufficiency. Its exploration of various factors such as energy production/security, water treatment, and equal societal considerations adds depth to the discourse.

In-text Citation: (“Characterising the Development Trends Driving Sustainable Neighborhoods,” n.d.)

Full Reference:
Characterising the Development Trends Driving Sustainable Neighborhoods. (n.d.).

3. “Self-Sufficient Neighbourhoods: Towards an Autonomous Integration of Buildings and Infrastructures” by Alexander Wandl et al.
A pivotal contribution, this paper provides theoretical insights into self-sufficient neighborhoods by exploring the integration of buildings and infrastructure. It lays a strong foundation for understanding the autonomous nature of such integrated systems in urban contexts.

In-text Citation: (Wandl et al., 2021)

Full Reference:
Wandl, A.,  Magoni, M. (2021). Self-Sufficient Neighbourhoods: Towards an Autonomous Integration of Buildings and Infrastructures.

4. “Mixed-Use Development: Theory and Practice in Search of a Balance” by Azrul Abdullah and Jeffrey T. Kenney
This reference holds significance for its comprehensive examination of mixed-use development, offering valuable perspectives on the equilibrium between theory and practice. Its insights are particularly pertinent to this study’s focus on embedding mixed-use architecture within self-sufficient neighborhoods.

In-text Citation: (Abdullah & Kenney, 2018)

Full Reference:
Abdullah, A., & Kenney, J. T. (2018). Mixed-Use Development: Theory and Practice in Search of a Balance.

5. “Towards Sustainable Cities: Expanding the Horizon of the New Urban Agenda” by UN-Habitat
This publication from a reputable source, UN-Habitat, aligns with this research on sustainable urban development. It discusses strategies for achieving sustainable cities, including the integration of self-sufficient neighborhoods and mixed-use architecture.

In-text Citation: (UN-Habitat, 2016)

Full Reference:
UN-Habitat. (2016). Towards Sustainable Cities: Expanding the Horizon of the New Urban Agenda.

6. “A new perception; generating well-being urban public spaces after the era of pandemics”
In the new pandemic era, the perception of urban spaces has been developed and the definition of well-being in urban public settings is ambiguous. The essay helps with theorizing the construction of urban public spaces and the health spaces influenced by green zones.

In-text Citation: (“A new perception,” n.d.)

Full Reference:
A new perception; generating well-being urban public spaces after the era of pandemics. (n.d.).

7. “China’s new city to showcase self-sufficient post-COVID design - Cities Today”
Guallart’s winning proposal is based on the idea of a “self-sufficient” city which incorporates local resource production and sustainability, and aims to reduce disruption to daily life “even in moments of confinement”, such as future pandemic lockdowns. It includes buildings with communal greenhouses to allow for food production and solar-panelled sloping roofs to produce energy. Small co-working “digital factories” offer 3D printers and rapid prototyping machines to produce everyday goods.

In-text Citation: (“China’s new city to showcase self-sufficient post-COVID design - Cities Today,” 2022)

Full Reference:
China’s new city to showcase self-sufficient post-COVID design - Cities Today. (2022).
8. “Decision making for sustainable urban energy planning: an integrated evaluation framework of alternative solutions for a NZED (Net Zero-Energy District) in Turin”
This paper presents an integrated evaluation framework for sustainable urban energy planning, focusing on achieving Net Zero-Energy Districts (NZEDs) in Turin. The study offers insights into decision-making processes and alternative solutions in the context of urban sustainability.

In-text Citation: (Becchioa et al., 2019)

Full Reference:
Becchioa, C., Botterob, M. C., Corgnatia, S. P., & Dell’Annab, F. (2019). Decision making for sustainable urban energy planning: an integrated evaluation framework of alternative solutions for a NZED (Net Zero-Energy District) in Turin.

9. “Smart contradictions: The politics of making Barcelona a Self-sufficient city”
This study explores the complexities and contradictions in the process of making Barcelona a self-sufficient city. It examines the political dynamics and challenges associated with the pursuit of self-sufficiency, shedding light on the intricate nature of sustainable urban development.

In-text Citation: (March & Ribera-Fumaz, 2012)

Full Reference:
March, H., & Ribera-Fumaz, R. (2012). Smart contradictions: The politics of making Barcelona a Self-sufficient city. Internet Interdisciplinary Institute, Universitat Oberta de Catalunya, Spain.

These references collectively contribute to the intellectual framework of self-sufficient neighborhoods and mixed-use building design, enhancing the discourse by providing theoretical insights, practical considerations, and a broader understanding of sustainable urban development.

Furthermore, the study's examination of different case studies is essential and is discussed in greater detail in Chapter 3 of the thesis.


BETTER TOGETHER

Chapter Two

# Exploring Self-Sufficiency Characteristics And Mixed-Use Design

*Illustrations: Ana María Ospina*

## sustainability and the importance of reducing the community's environmental impact

Sustainability is a fundamental concept in environmental science and refers to the ability of a system or process to maintain its balance and functionality over the long term while minimizing negative impacts on the environment and society . Designing for sustainability is crucial to address the pressing challenges of climate change, resource depletion, and environmental degradation.

Reducing the community's environmental impact through sustainable design is of paramount importance for several reasons:

Environmental Preservation: Sustainable design aims to minimize resource consumption and waste generation, leading to reduced greenhouse gas emissions and environmental pollution. By incorporating energy-efficient technologies, renewable energy sources, and eco-friendly materials, sustainable buildings and urban areas can contribute to mitigating climate change and protecting ecosystems .

Resource Conservation: Sustainable design emphasizes the responsible use of natural resources, such as water and land. It promotes strategies like rainwater harvesting, water recycling, and green infrastructure to enhance water management practices and protect water resources for future generations .

Social Equity: Sustainable design considers the needs of diverse communities and promotes inclusive, people-centered streets and urban spaces. By creating accessible, safe, and healthy environments, sustainable design fosters social cohesion, enhances public health, and reduces inequalities in urban areas .

Long-term Economic Benefits: Though the initial investment in sustainable design may seem higher, the long-term benefits outweigh the costs. Energy-efficient buildings and infrastructure lead to reduced operational expenses and lower utility bills. Moreover, sustainable development attracts eco-conscious businesses and residents, boosting local economies .

Future-proofing: Designing with sustainability in mind ensures that buildings and communities are resilient to climate change impacts. With an unpredictable future, it is essential to adopt practices that enhance adaptability and reduce vulnerabilities .

By prioritizing sustainability in design, we can create a built environment that minimizes environmental harm, promotes social well-being, and supports economic growth while safeguarding the planet for future generations.

## The Definitions of Self-Sufficient Community

The definition of being self-sufficient is being able to fulfill one's own needs without help from others while the term community means people living in one place, like district or city and considered as a whole (Oxford Advanced Dictionary, 2001).

## Self-sufficiency characteristics

The Self-Sufficient Neighborhood links urban and building scale in a smart design and demonstrating how radical ideas on Self-Sufficiency can reach reality, empowering cities to produce the whole amount of their needed resources.
Self-Sufficiency is no more a theory which suggests how to act in a further future, Self-Sufficiency can be considered a new kind of architectural approach from the urban scale to the building scale.

An area of the city is self-sufficient when it has a variety of activities and design should make emphasis on dense, collective and complexity of activities.
A self-sufficient community can begin at a smaller scale for instance, a self-sufficient urban housing.
A self-sufficient dwelling project should be connected to nearby structure in order to balance the excess and lack of interaction (Fraga & Burg, 2006).
A self-sufficient dwelling is one that is connected to the local system and knows how to respond to the social, cultural, technical and economics of its surroundings (Guallart, 2006).

1. Electrify Transport
2. Food Production
3. Efficient Architecture
4. Solar Architecture and energy production
5. People-centered streets and green mobility
6. Water Management
7. Matter Cycle
8. New Architecture
9. Green Spaces, Urban Nature
10. Facilities

Electrify Transport: This characteristic involves transitioning transportation systems towards electric vehicles (EVs) and sustainable public transportation powered by renewable energy sources, such as solar or wind. By electrifying transport, self-sufficient neighborhoods can reduce greenhouse gas emissions and air pollution, contributing to cleaner and more sustainable urban mobility. This transition is a key aspect of sustainable transportation and urban planning. [Reference: (International Energy Agency, 2021)]

Food Production: Self-sufficient neighborhoods prioritize local food production through urban agriculture, community gardens, and urban farming initiatives. By cultivating fruits, vegetables, and herbs locally, these neighborhoods can enhance food security, reduce the carbon footprint associated with food transportation, and promote healthier eating habits among residents. Additionally, urban farming can create opportunities for community engagement and strengthen social ties within the neighborhood. [Reference: (Food and Agriculture Organization of the United Nations, 2019)]

Efficient Architecture: Efficient architecture focuses on sustainable building design, utilizing passive strategies to optimize energy efficiency. This includes passive heating and cooling techniques, such as natural ventilation and shading, as well as energy-efficient building materials and technologies. By reducing energy consumption in buildings, self-sufficient neighborhoods can lower their environmental impact while creating comfortable and resource-efficient living spaces. [Reference: (U.S. Department of Energy, n.d.)]

Solar Architecture and Energy Production: Solar architecture integrates photovoltaic panels, solar facades, and solar roofs into building design to harness solar energy for electricity generation. By incorporating solar technology into the urban fabric, self-sufficient neighborhoods can produce renewable energy locally and decrease reliance on conventional power sources. This approach contributes to sustainable energy generation and a lower carbon footprint. [Reference: (U.S. Department of Energy, n.d.)]

People-centered Streets and Green Mobility: This characteristic involves designing streets and public spaces to prioritize pedestrians and cyclists, encouraging active transportation and reducing the dominance of motor vehicles. By providing ample walking and cycling infrastructure, self-sufficient neighborhoods promote green mobility options and create vibrant, pedestrian-friendly environments that foster social interactions and community engagement. [Reference: (World Health Organization, 2021)]

Water Management: Self-sufficient neighborhoods implement sustainable water management practices to reduce water waste and promote water conservation. This may include rainwater harvesting systems, greywater recycling, and the use of permeable surfaces to manage stormwater runoff. By integrating such practices, these neighborhoods can improve water efficiency and resilience in the face of water scarcity and climate change. [Reference: (United Nations, 2021)]

Matter Cycle: The matter cycle characteristic revolves around adopting a circular economy approach, aiming to minimize waste generation and promote resource recovery. In self-sufficient neighborhoods, waste is considered a resource, and recycling and upcycling initiatives are prioritized. By closing the loop on material use, these neighborhoods reduce their environmental impact and contribute to a more sustainable waste management system. [Reference: (Ellen MacArthur Foundation, 2015)]

New Architecture: New architecture in self-sufficient neighborhoods emphasizes innovative and adaptable designs that respond to changing environmental and social needs. This may include modular construction, sustainable materials, and buildings designed for multi-functional use. By embracing new architectural approaches, these neighborhoods can be more flexible, resilient, and better equipped to address future challenges. [Reference: (United Nations, 2019)]

Green Spaces, Urban Nature: Self-sufficient neighborhoods integrate green spaces, urban parks, and nature within their urban fabric to enhance biodiversity, improve air quality, and provide recreational opportunities for residents. These green spaces serve as vital oases within the urban environment, promoting physical and mental well-being while creating a connection to nature in the city. [Reference: (World Health Organization, 2016)]

Facilities: Self-sufficient neighborhoods offer a comprehensive range of facilities that cater to residents' needs, including educational institutions, healthcare centers, cultural venues, and community gathering spaces. The availability of such facilities enhances the quality of life for residents and fosters a self-sustaining and vibrant local community. [Reference: (United Nations, 2019)]

By incorporating these self-sufficiency characteristics into their urban planning and design, self-sufficient neighborhoods can create holistic, sustainable, and inclusive living environments that address contemporary urban challenges while promoting a more resilient and equitable future.

## Self-sufficiency in different scales-specific case of Barcelona *(evaluation of facilities in Barcelona)*

The proposition regarding amenities within the self-sufficient prototype draws inspiration from an examination of facilities within our city reference, Barcelona. Over a span of four decades, the population of the Barcelona metropolitan area has remained relatively steady, whereas the number of facilities has tripled. In 1975, the metropolis housed 3 million people, accompanied by over 1,800 facilities. By 2015, the population had grown to 3.2 million, with nearly 6,000 facilities established.

Throughout the past fifty years, the trajectory of facilities in Barcelona has traversed various phases. Initially, there were centralized facilities during the period of dictatorship, followed by a shift towards decentralization in the 1980s, coinciding with the advent of democracy. This transition led to the establishment of facilities at the neighborhood level in new municipalities. These included libraries, sports centers, cultural hubs, and notably, civic centers as platforms for community engagement.

The subsequent decade witnessed a concentration of facilities in specific city areas, designated as new focal points. This era was marked by the construction of key cultural landmarks such as art museums like MACBA and CCCB, the National Theatre, and the Music Auditorium.

The financial crisis of 2008, coupled with the proliferation of Information Technologies, prompted the replacement of certain facilities by services, including postal and municipal offices. Anticipating the future, novel paradigms such as sharing (time, space, services), interchange (goods, knowledge, services), network (cultural, social, collaborative), and distance-based facilities (e-learning, e-doctor) are poised to influence facility evolution.
Throughout the diverse stages of Barcelona's facility evolution, markets have retained their significance as local amenities.

Within the self-sufficient neighborhood model, amenities are categorized across four tiers: city, neighborhood, hyper-block, and block levels. At the city level, a hospital and a university biomedical research center stand as primary facilities. The majority of amenities are situated at the neighborhood level, often centralized within a singular hub serving the immediate area, although distribution across other tiers also occurs in certain instances. Hyper-block level facilities encompass educational and sports centers, while block-level facilities cater exclusively to specific blocks within the neighborhood.

## Characteristics

Facility characteristics commonly adhere to established standards. The table outlining the attributes of the prototype's facilities (excluding those at the city level) delineates the primary standards. Notable benchmarks in facility planning include the area (facility size in square meters) and distance (influence area, measured in meters or minutes of walking). The distribution pertains to facility placement, considering both singular and multiple locations based on the facility's scale. Categorized by age group, facilities cater to specific demographic segments. While certain facilities necessitate indoor spaces, others find their place in public open areas. Predominantly public, many facilities fall under this category, although instances arise, particularly in education and health, where private entities may provide these services. The table's concluding sections introduce non-traditional standards: e-facility and temporary. The former encompasses the notion of distance-based services (e-education, e-health, e-commerce, etc.), while the latter gauges the facility's ability to operate on a temporary basis, such as during specific times of the day or week (night markets, weekly markets) or in non-permanent locations (pop-up facilities).

## Area

The graph illustrates the distribution of various facility types and categories within the neighborhood. In total, the facilities occupy an area of

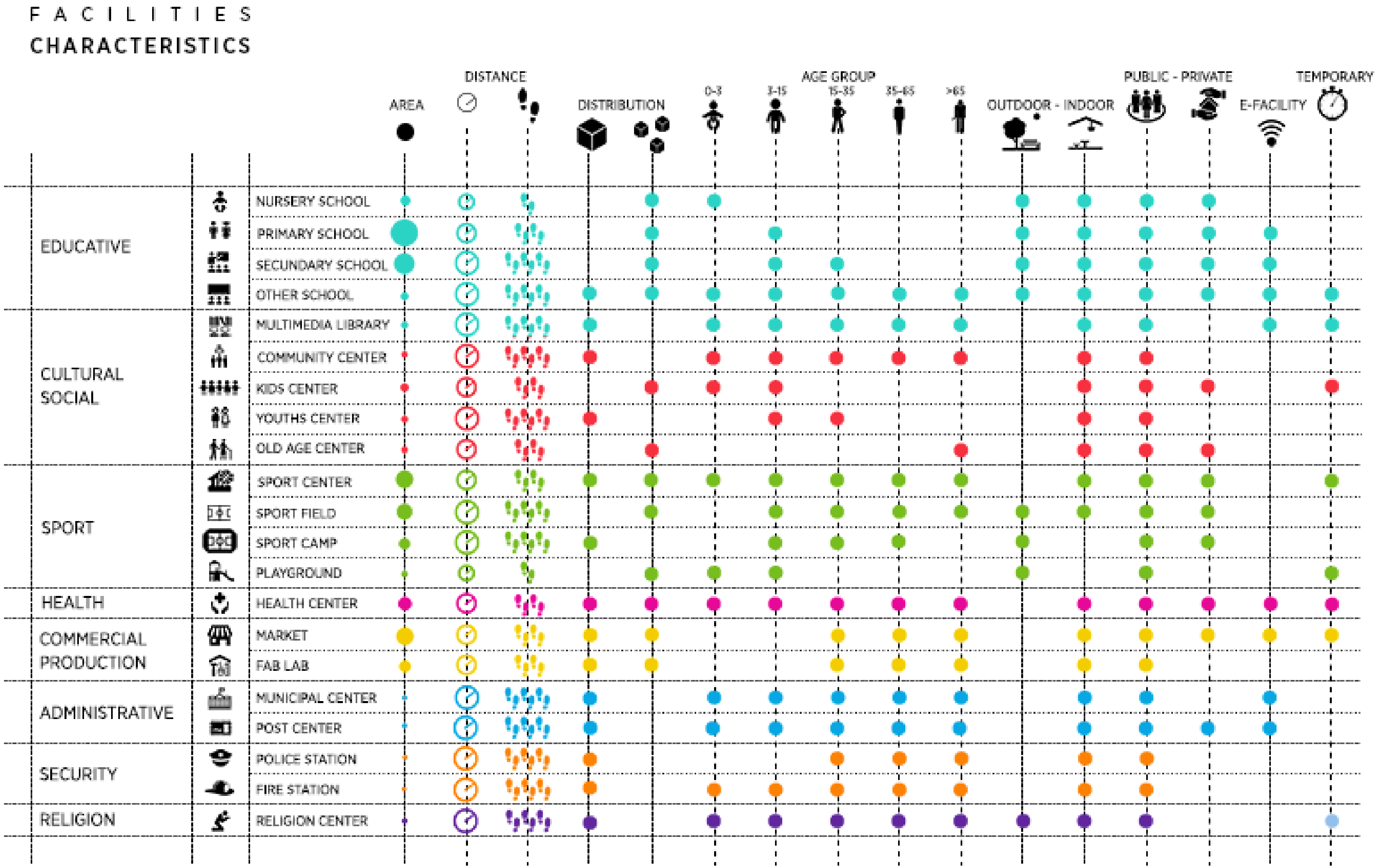



*Figure 2: Facilities Characteristics*
*Reference: IAAC Blog. (2016). Facilities for a Self-Sufficient Neighborhood.*

97,500 square meters, equating to approximately 3.9 square meters of facilities per individual. Among these, educational, sports, and commercial production facilities demand the most space: educational establishments such as nurseries, primary and secondary schools span 40,600 square meters, sports facilities encompassing centers, fields, camps, and playgrounds occupy 23,400 square meters, and commercial spaces including markets and fab labs cover 14,200 square meters.

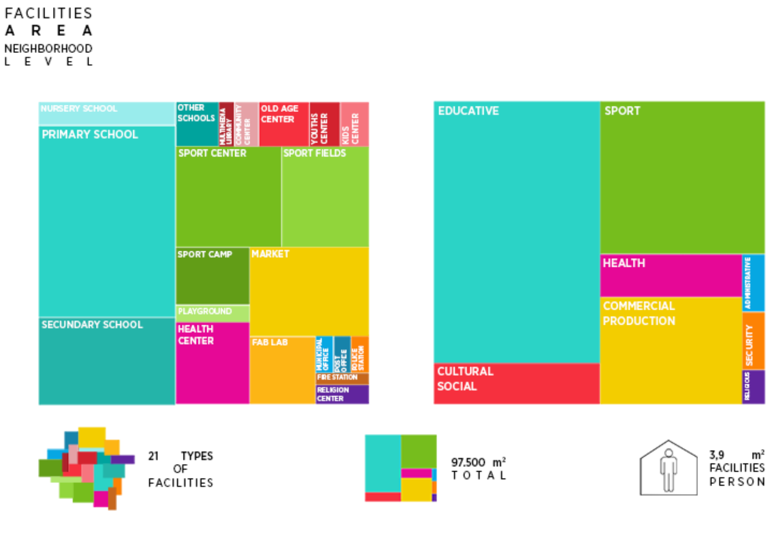



*Figure 3: Facilities- Area*
*Reference: IAAC Blog. (2016). Facilities for a Self-Sufficient Neighborhood.*

## Distance

Each facility operates within a distinct sphere of influence, determined by its service scale. The distance between every point in the neighborhood and the various facilities is denoted in either meters or minutes of walking. Facilities with the most localized reach are nursery schools and playgrounds, spanning a radius of 250 meters or a 5-minute walk. Within a range of 500 to 600 meters (approximately 10 minutes of walking), hyper-block level facilities like primary schools, kids centers, and centers for the elderly are situated. The remaining facilities encompass a radius of influence spanning 600 to 800 meters (equivalent to 12-16 minutes).

Neighborhood-level facilities are categorized into two clusters: daily-use facilities situated within 600 to 700 meters (e.g., markets, secondary schools, religious centers), and non-daily-use facilities positioned between 700 and 800 meters (e.g., sports camps, municipal offices, police stations). Lastly, city-level facilities may be positioned at distances exceeding 1,000 meters from any point in the neighborhood, as they cater to the entire city's needs.

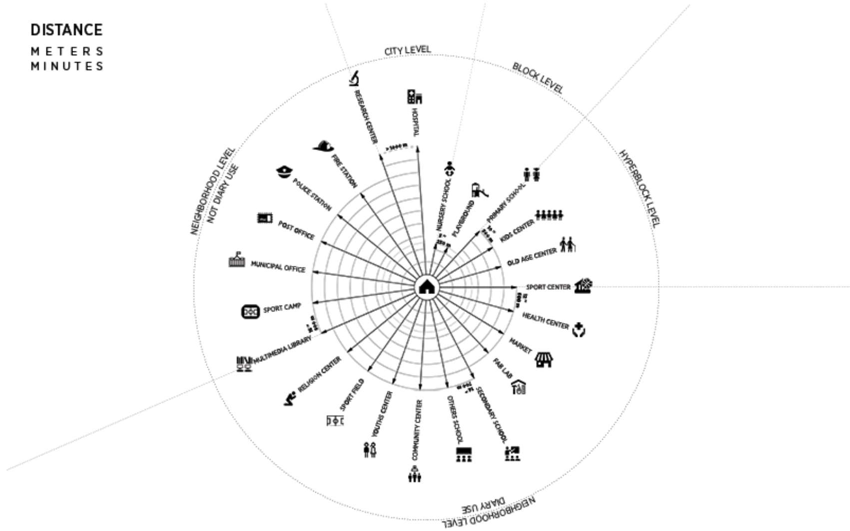



*Figure 4: Facilities- Distance*
*Reference: IAAC Blog. (2016). Facilities for a Self-Sufficient Neighborhood.*

## Distribution Strategy

Facilities within the prototype adhere to four distinct strategies of distribution, corresponding to the four different facility scales.

For city-level facilities, their placement is in proximity to the perimeter roads, facilitating swift connections between various neighborhoods within the city.
In the case of neighborhood-level facilities, they are strategically situated within the heart of the neighborhood, in close proximity to the main roads. This strategic positioning ensures convenient access from every point within the area. Notably, this cluster of facilities is dispersed along the diagonal that links city-level facilities, the primary green space on the opposing corner of the neighborhood, and the central road intersection, which serves as the civic focal point of the district.
Hyper block-level facilities find their location within the central area of each hyper block, in close proximity to the intersection of its primary roads.
Lastly, block-level facilities are dispersed throughout the neighborhood, typically occupying the ground floor of residential buildings and positioned near pedestrian pathways.

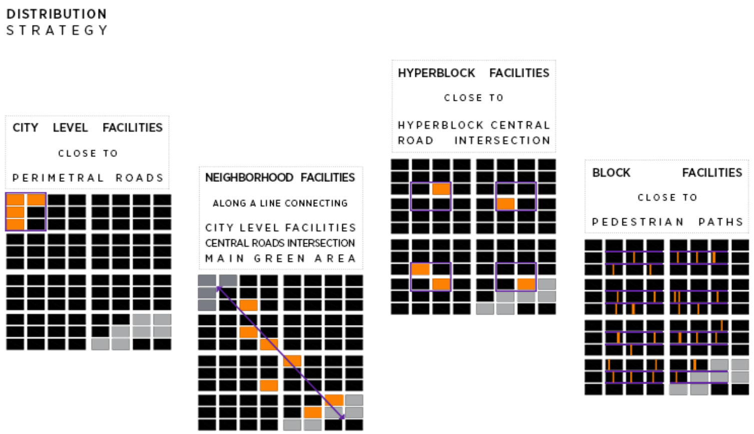



*Figure 5: Distribution strategy*
*Reference: IAAC Blog. (2016). Facilities for a Self-Sufficient Neighborhood.*

## Distribution Plan

The various clusters of amenities are strategically positioned across the community, adhering to specific guidelines tailored to the magnitude of each amenity. Plot dimensions exhibit diversity, corresponding to the significance of individual amenities. Additionally, another guideline dictating amenity placement pertains to their proximity to communal areas, verdant spaces, and open squares.*(Reference: IAAC Blog. (2016). The Four Groups of Facilities for a Self-Sufficient Neighborhood. )*

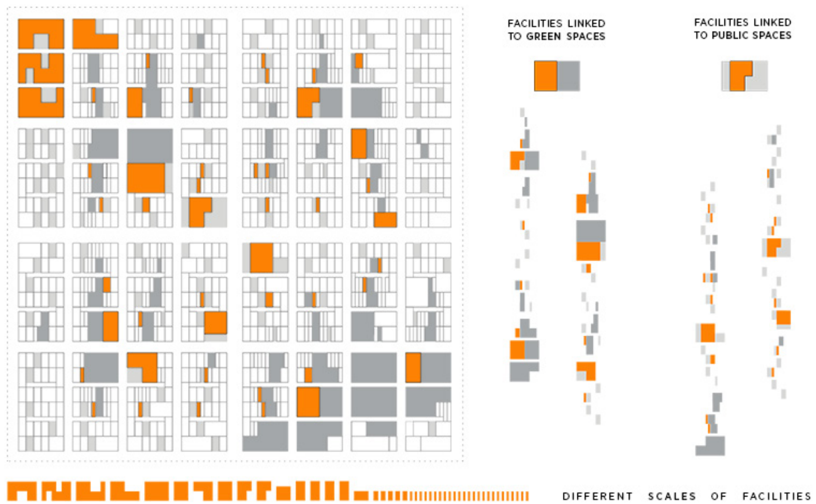



*Figure 6: Distribution strategy*
*Reference: IAAC Blog. (2016). Facilities for a Self-Sufficient Neighborhood.*

hospitals, collectively occupying 110,000 square meters, while the remaining categories require 95,000 square meters.

## Uses Distribution plan

At the hyper block level, educational facilities also dominate, with nursery, primary, and secondary schools predominantly situated at the center of each hyper block.
Buildings designed for mixed-use purposes are strategically positioned along the primary roads within the neighborhood, in close proximity to the central intersection. This central area functions as the core civic space within the neighborhood, hosting several crucial community facilities. These include the market, fab lab, religious center, municipal and postal offices, community center, multimedia library, centers for children, youths, and the elderly, as well as a sports and health center.

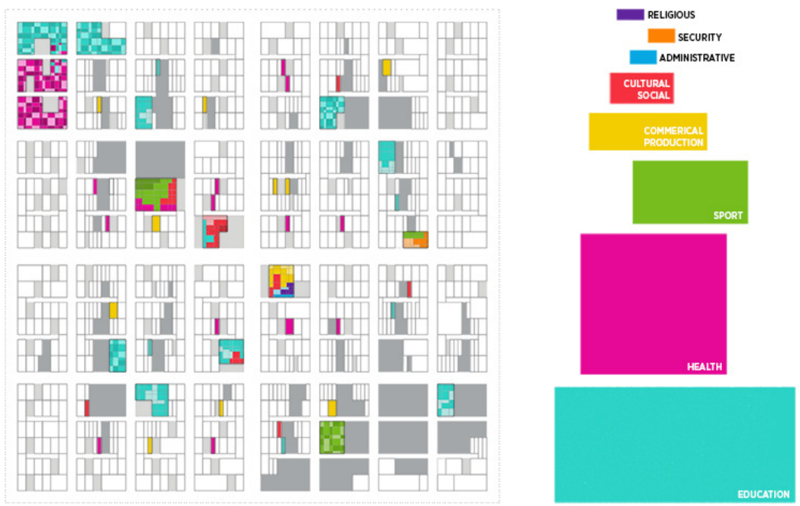



*Figure 7: Uses Distribution plan*
*Reference: IAAC Blog. (2016). Facilities for a Self-Sufficient Neighborhood.*

## Relations Between Facilities

Studying the interrelationships among facilities delves into the extent of connections between diverse functions, aiming to identify clusters of facilities that could coexist within the same structure.

Four criteria play a pivotal role in determining the strongest linkages between facilities. The initial criterion hinges on the category: facilities within the same category demonstrate stronger affinities compared to those spanning distinct categories (for example, security facilities like police and fire stations).

Another criterion revolves around users: when facilities serve similar user groups (e.g., children utilizing both primary schools and kids centers), a robust connection emerges between them. Additionally, the synergy of functions fosters connections between facilities (for instance, locating a kids center adjacent to a sports center benefits parents seeking to engage in sports activities). The final criterion takes into account usage frequency: facilities used daily, such as markets and religious centers, exhibit heightened interconnections, whereas non-daily facilities like police stations show comparatively weaker ties. Since users visit these daily-use facilities frequently, co-locating them enhances efficiency.

In the comprehensive diagram illustrating facility relationships, the strength of a connection is visualized through the thickness of the line linking two facilities. The color of each facility's circle denotes its service category, while the circle's size represents the facility's area.

Upon analyzing the interrelations between each facility and others, it becomes evident that educational and cultural-social facilities exhibit the most robust connections. Similarly, sport centers, markets, and religious centers also showcase substantial interconnections.

## RELATIONS BETWEEN FACILITIES

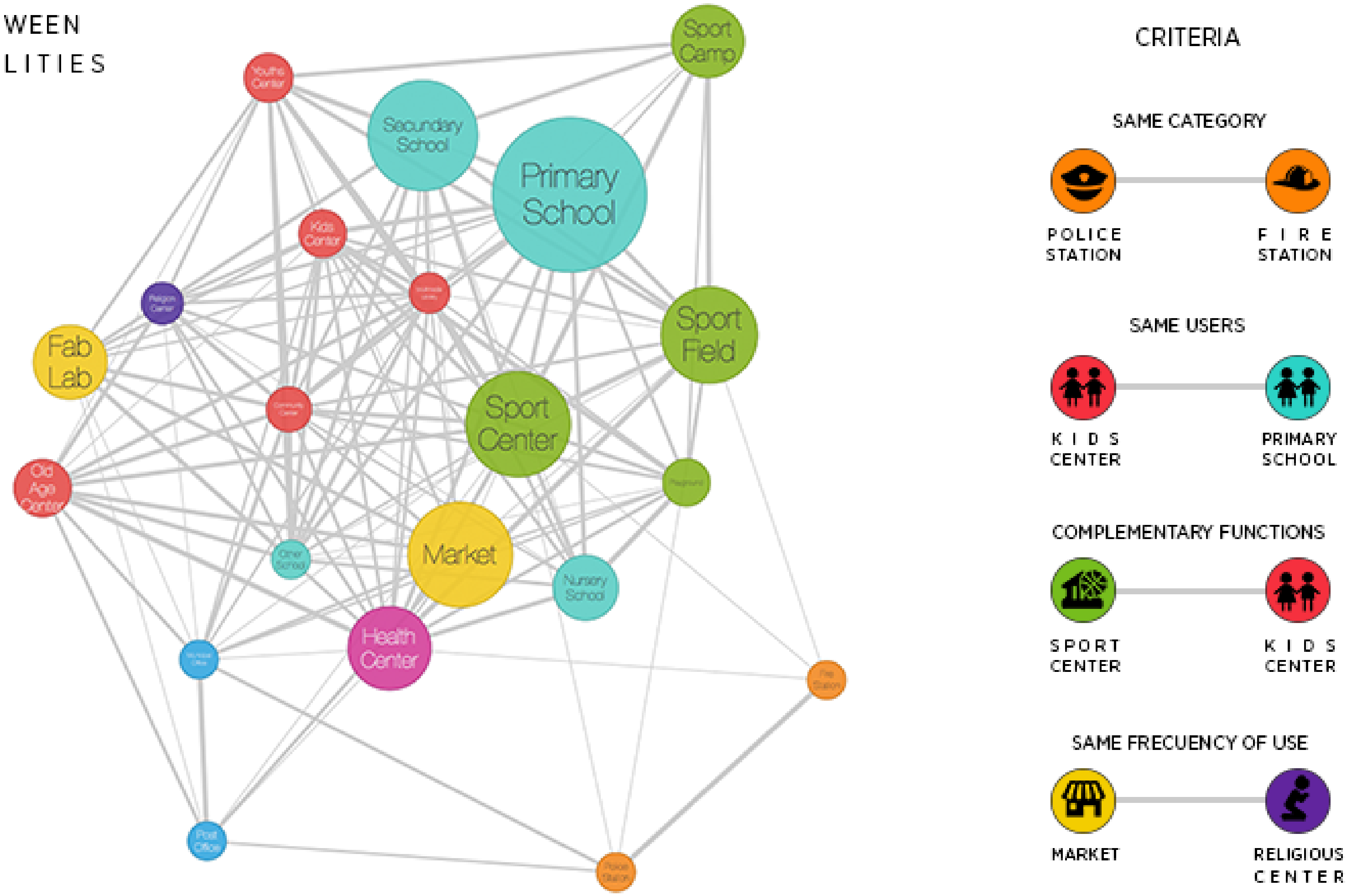



*Figure 8: Relations between facilities*
*Reference: IAAC Blog. (2016). Facilities for a Self-Sufficient Neighborhood.*

## Hybrid Facilities Buildings

The proposition outlining facilities within the prototype outlines the establishment of five mixed-use facility buildings, three of which are strategically positioned near the intersection of the main roads.

In the heart of the neighborhood, the primary market is housed within the same structure as another commercial space, a fab lab. Adjacently, the religious center finds placement in close proximity to the market, underscoring the interrelation between food and religious practices. Additional civic functions are situated alongside religious and commercial facilities, encompassing the community center, municipal, and postal offices.

A different mixed-use building is situated facing the hybrid market. This particular center combines cultural amenities with facilities aimed at young individuals. It comprises a multimedia library, an educational center, and centers catering to both youths and children.

The third hybrid building, located in the vicinity of the neighborhood's core, harmonizes sport and health functions. Within its premises, a health center shares space with an old age center, a sports center, and sports fields. Notably, this structure is positioned adjacent to the neighborhood's sports camp.

The remaining two hybrid buildings are situated along the main roads of the neighborhood. The first accommodates a security center encompassing a police and fire station, in addition to indoor sports fields. The second center serves as a focal point for both young and elderly individuals, incorporating a nursery and primary school along with an old age center. *(Reference: IAAC Blog. (n.d.). The Four Groups of Facilities for a Self-Sufficient Neighborhood. Retrieved from https://www.iaacblog.com/projects/facilities-for-a-self-sufficient-neighborhood/)*

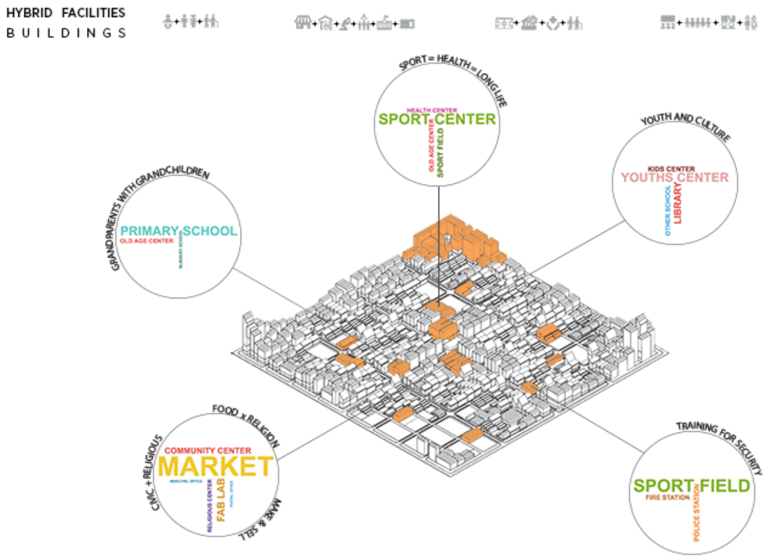



*Figure 9: Hybrid Facilities Buildings*
*Reference: IAAC Blog. (2016). Facilities for a Self-Sufficient Neighborhood.*

Barcelona's plan to become a self-sufficient city involves the use of digital technologies to create a low carbon emission economy. The city council has started to put this plan into motion by implementing pilot projects and then applying them to the whole city. The plan includes the construction of self-sufficient blocks, which are designed to use local resources and have low carbon emissions. These blocks will include some 2000 apartments that follow environmental and energy guidelines. The plan also involves the use of district heating and cooling systems, which are expected to become the most important energy project in the city and an example of a new energy paradigm.*(March & Ribera-Fumaz, 2016)*

## The importance of self sufficient neighbourhood after covid era

The COVID-19 era has had a profound impact on cities and urban planning, prompting a shift towards self-sufficient neighborhoods. The importance of self-sufficient neighborhoods after the COVID era lies in their ability to address the vulnerabilities and challenges exposed by the pandemic and to create more resilient, sustainable, and healthy communities.

Resilience to Pandemics: Self-sufficient neighborhoods are designed to minimize disruptions to daily life during future pandemic lockdowns or other crises. They incorporate local resource production, such as food and energy, reducing dependence on global supply chains and ensuring essential needs can be met locally even during emergencies .

Sustainable Living: These neighborhoods prioritize sustainability, incorporating green spaces, communal greenhouses, solar panels, and energy-efficient technologies. By promoting renewable energy and circular economy principles, they aim to reduce the ecological footprint and contribute to mitigating climate change .

Hyperlocalization: Self-sufficient neighborhoods foster hyperlocalization, where communities rely on local resources, services, and products. This trend encourages support for local businesses and reduces dependence on long-distance supply chains, making neighborhoods more resilient in times of global disruptions .

Enhanced Community Well-being: By incorporating green spaces and communal facilities, self-sufficient neighborhoods promote social interaction, well-being, and community cohesion. Access to green spaces and nature has been proven to have positive effects on mental health, reducing stress and enhancing overall well-being .

Urban Planning Reimagined: The COVID-19 pandemic has prompted a reassessment of urban planning and design. Self-sufficient neighborhoods embody a new urban life based on circular bioeconomy principles, empowering cities and communities to be more self-reliant and adaptable to changing circumstances .

Reducing Globalization Pressures: The pandemic has highlighted the limitations and vulnerabilities of a highly globalized world. Self-sufficient neighborhoods offer an alternative model that reduces the pressure on mega-cities and allows for the decentralization of economic activities and population distribution .

Positive Impact on Health: Self-sufficient neighborhoods can promote healthier lifestyles by encouraging walking and cycling due to better urban planning and proximity to amenities. Reduced air pollution from fewer transportation activities can lead to improved air quality and public health outcomes .

As seen in China’s Xiong’an New Area development near Beijing, which incorporates self-sufficiency principles and post-COVID design ideas, these neighborhoods can serve as models for future urban developments worldwide. Embracing the concept of self-sufficient neighborhoods can lead to more sustainable, resilient, and thriving communities, better prepared to face future challenges

There are several challenges facing the Sustainable Development Goals (SDGs), including inequitable distribution of food-energy-water resources, environmental crises, gaps between the vision for SDG realization and actual capacity, turbulent geopolitical environment, spatial inequities, and trade-offs. The COVID-19 pandemic has further exacerbated these challenges, delaying SDG advancement, amplifying spatial imbalances, undermining connectivity, and accentuating anti-globalization sentiment under lockdowns and geopolitical conflicts. The health crisis and socio-economic recession resulting from COVID-19 have severely impeded SDG progression. the COVID-19 pandemic has highlighted the importance of achieving the SDGs, which include goals related to health, education, poverty reduction, and environmental sustainability. (Zhao et al., 2022)

## Challenges and opportunities

Challenges:
Infrastructure: Designing a self-sufficient neighborhood requires careful planning of infrastructure to support local resource production, such as energy and food. This may involve integrating renewable energy sources, greenhouses, and waste management systems, which can be challenging to implement effectively .

Land Use Zoning: Creating a diverse mix of land uses within the neighborhood can be challenging due to zoning regulations and existing urban planning policies. Balancing residential, commercial, and recreational spaces while ensuring proximity to essential services is crucial for self-sufficiency .

Behavioral Change: Encouraging residents to adopt sustainable practices and participate in local resource production requires behavioral change. Education and community engagement are essential to fostering a sense of responsibility and participation among residents.

Economic Viability: The economic viability of self-sufficient neighborhoods needs careful consideration. Balancing the cost of sustainable infrastructure and maintaining affordability for residents can be a challenge .

Space Constraints: Compact mixed-use buildings face challenges in optimizing limited space to accommodate various functions. Balancing residential, commercial, and public spaces while ensuring adequate amenities requires innovative design solutions .

Zoning and Regulations: Compliance with zoning regulations and building codes can be challenging when integrating diverse functions within a compact structure. Striking a balance between different activities while meeting legal requirements can be complex .

Accessibility: Ensuring easy access to different areas within the building for residents and visitors is crucial. Designing efficient circulation paths and transportation options within a limited space can be a significant challenge .

Opportunities:
Resilience and Sustainability: Self-sufficient neighborhoods offer the opportunity to create more resilient and sustainable communities. By reducing dependence on external resources and promoting local production, these neighborhoods can withstand external shocks and contribute to environmental conservation .

Community Empowerment: Designing self-sufficient neighborhoods presents an opportunity to empower communities and strengthen social bonds. Residents become active participants in the management of local resources, fostering a sense of ownership and pride in the neighborhood .

Innovation and Technology: Self-sufficient neighborhoods encourage the integration of innovative technologies for sustainable living. Implementing smart grids, energy-efficient buildings, and advanced waste management systems can pave the way for future urban developments .

Environmental Impact: By promoting local resource production and reducing reliance on long supply chains, self-sufficient neighborhoods have the potential to lower the carbon footprint and minimize environmental impact .

Urban Density: Compact mixed-use buildings contribute to urban density, which can lead to reduced urban sprawl and more efficient land use. Increased density supports public transportation and walkability, promoting a sustainable urban environment .

Vibrant Urban Centers: Mixed-use buildings create vibrant urban centers with a mix of activities, attracting a diverse population. The presence of commercial, residential, and recreational spaces fosters a sense of community and liveliness .

Environmental Efficiency: Compact mixed-use buildings can incorporate energy-efficient features and sustainable building practices, contributing to environmental conservation and lowering carbon emissions .

In conclusion, designing self-sufficient neighborhoods and compact mixed-use buildings presents both challenges and opportunities. Overcoming the challenges requires innovative urban planning, community engagement, and consideration of economic viability. Embracing the opportunities can lead to more resilient, sustainable, and vibrant urban environments that contribute to a better quality of life for residents.

Optimised ecosystem refers to an ecosystem that is managed in a way that maximizes its benefits to human populations while minimizing negative impacts on the environment. optimised ecosystem service demand means that the demand for ecosystem services in urban areas is managed in a way that ensures the sustainable provision of these services while enhancing human well-being. This involves identifying the essential ecosystem services needed in urban areas, setting benchmarks for optimal demand, and implementing policies and practices that promote sustainable use of these services.

there are challenges and limitations to implementing the approach of urban self-sufficiency through optimised ecosystem service demand in European cities. Some factors that can affect the success of this approach include institutional stability, targeted legislation and policies, citizen awareness, societal engagement, and resource availability . Additionally, wealth seems to be a positive factor at the city scale but a negative one at a household scale . However, European predominantly small, polycentric cities may be in a better position to achieve optimal UES demand values due to enhanced accessibility to urban ecosystems. (Rodrı´guez-Rodrı´guez et al., 2015, p. 7)

## Mixed-use development and its benefits

During the development of traditional zoning regulations, the focus was on separating different types of land uses due to the negative impacts associated with factories and commercial activities at that time. These uses often generated noise, odors, and hazards that posed risks to public health and property values. Thus, the primary goal was to minimize nuisances and protect residents.

However, in the present day, many commercial developments have become environmentally friendly, and there are now recognized benefits to having different uses located in close proximity to each other. Mixed-use concentrated development, especially when situated near public transportation, is considered a crucial tool for “smart growth.” It helps reduce dependence on automobiles, preserves green spaces and natural resources, and promotes sustainable development practices.

As a result, many communities are embracing the concept of “mixed-use”, which involves intentionally blending various functions such as housing, civic uses, and commercial activities like retail, restaurants, and offices.

Mixing uses, however, works best when it grows out of a thoughtful plan that emphasizes the connectivity and links among the uses. Results may be haphazard when communities simply enable multiple uses without providing guidance about the mix of uses and how they are spatially related.

Communities have diverse motivations for embracing mixed-use development. Some view it as an effective means to incorporate a variety of housing types while enhancing the character of traditional towns on a smaller scale. Others see it as a powerful tool for revitalizing struggling areas and driving economic development. There are also those who utilize mixed-use to create or enhance vibrant village centers. The numerous benefits of mixed-use development are outlined below:

• Revitalization: Mixed use can spark the rejuvenation of areas by attracting investment, improving infrastructure, and fostering economic activity.

•High-Quality Design: By allowing greater flexibility and control, mixed-use development encourages the implementation of superior design standards.

•Preservation of Traditional Village Centers: Mixed use helps preserve and enhance the unique character and charm of traditional village centers.

•Village-Style Mix: It promotes a blend of retail establishments, restaurants, offices, civic facilities, and multi-family housing, creating a vibrant and diverse community.

•Expanded Housing Opportunities: Mixed use provides more options and choices for housing, accommodating a range of needs and preferences.

•Affordable Housing Potential: There is a possibility of increased availability of affordable housing within mixed-use developments.

•Enhanced Identity and Development Potential: By focusing on village centers, locations near bike paths, or other "gateway" areas, mixed use enhances the distinctive identity and development potential of an area.

•Promotion of Pedestrian and Bicycle Travel: Mixed use encourages walking and cycling, promoting a healthier and more sustainable mode of transportation.

•Reduction of Auto Dependence: By co-locating various destinations, mixed use reduces reliance on automobiles, alleviates roadway congestion, and decreases air pollution.

•Sense of Community: Mixed-use development fosters a sense of community by creating spaces that facilitate social interactions and community engagement.

•Sense of Place: It contributes to the creation of a unique sense of place, where residents feel connected to their surroundings and have a strong attachment to their community.

•Economic Investment: Mixed use attracts economic investment, generating business activity and creating job opportunities.

•Efficient Use of Land and Infrastructure: By optimizing land and infrastructure utilization, mixed use minimizes sprawl and maximizes resource efficiency.

•Guided Development: It directs development towards established areas, protecting rural spaces and environmentally sensitive resources on the outskirts.

•Enhanced Vitality: Mixed-use development brings vibrancy to communities, making them more dynamic and appealing.

•Improved Commonwealth Capital Score: Embracing mixed use can positively impact a municipality's Commonwealth Capital score, indicating its overall quality and desirability.

•Embodiment of Smart Growth: Mixed use aligns with the principles of smart growth, emphasizing sustainable and balanced urban development.

•Increased Revenues: The combination of commercial and residential elements in mixed-use developments can lead to increased tax revenues for communities.

While mixed use is particularly advantageous near public transportation, it offers benefits in other areas as well. These advantages include the preservation of undeveloped or environmentally sensitive land elsewhere in the community, opportunities for diverse housing options, the creation of bicycle and pedestrian-friendly destinations, and an enhanced sense of place and community.

When developing a bylaw, communities should carefully select the benefits that align with their specific goals and structure the provisions accordingly.

Chapter Three

# Self-sufficient Community, International Case Studies Useful For Understanding Its Values And Critical Issues

*Illustrations: Ana María Ospina*

This chapter employs case studies as a powerful lens to explore the intricacies of self-sufficient communities. Our selection of these case studies was guided by the aim of highlighting diverse approaches to self-sufficiency within various urban contexts. These chosen cases serve as vivid examples that shed light on the dynamic relationship between self-sufficiency characteristics which we examined in the previous chapter of this study, and real-world responses.

The decision to include these specific cases was driven by their potential to illustrate the spectrum of self-sufficiency possibilities. Each case was carefully considered to reveal its unique strengths and weaknesses in addressing self-sufficiency attributes. In doing so, we aim to draw insights from these cases that can inform our understanding of how self-sufficiency can be harnessed in different scenarios.

Additionally, we examined compact mixed-use buildings within some of these cases to understand their potential role in achieving self-sufficiency goals. By analyzing the integration of mixed-use structures within self-sufficient contexts, we sought to uncover how compact design strategies can contribute to the broader objective of sustainable communities. Through these case studies, we navigate the intricate interplay between self-sufficiency and mixed-use architecture, unraveling innovative pathways for urban design.

## Why the case study approach?

The selection of the case study approach for this thesis is grounded in its suitability for comprehensively exploring the intricate interplay between self-sufficiency principles and urban design within diverse contexts. Self-sufficient neighborhoods and mixed-use architecture are multifaceted concepts that manifest differently depending on geographical, cultural, and socio-economic factors. By delving into specific case studies, we can dissect the real-world applications of these principles, considering their inherent potentials and vulnerabilities. This approach allows us to move beyond abstract theories and generalizations, instead offering a nuanced understanding of how self-sufficiency can be tailored to unique urban settings. Through empirical examination, we aim to distill valuable lessons from each case study, identifying best practices, potential pitfalls, and innovative solutions that can inform future sustainable urban development endeavors. In essence, the case study approach aligns seamlessly with the holistic nature of self-sufficiency and mixed-use architecture, enabling us to draw upon real-world experiences to enrich our theoretical foundations and advance our collective knowledge of urban sustainability.

## 1. First Circular, Self-Sufficient Communities for Sweden

White Arkitekter, in collaboration with ReGen Villages based in Silicon Valley, have partnered to establish completely circular and self-sufficient communities in Sweden. Drawing inspiration from the world of computer games, the initiative implements strategies like organic food cultivation, locally generated and stored energy, comprehensive recycling programs, and construction of climate-positive structures.

Aligned with the Global Goals for Sustainable Development, the endeavor, scheduled to commence in 2020, seeks to enhance the resilience of urban centers and communities by reducing the strain on central infrastructure. Leveraging the latest climate-conscious technologies tailored to specific site conditions, ReGen Village introduces innovative solutions for food, energy, and water. These facets are ingeniously interwoven into a unified circular system with the aid of the Village OS, employing artificial intelligence and machine learning. The system envisions the provision of food from vertical farming and aquaponics, energy from solar panels and locally sourced biogas generated from waste, and water that is harvested, purified, and reused.

With the integration of AI on a community scale, this platform paves the way for the establishment of similar self-sustaining communities worldwide. Drawing inspiration from the concept of “smart homes,” the Village OS has the potential to extend its transformative influence to entire communities, rendering them “smart” in much the same manner. Indeed, this approach facilitates the digital orchestration and equilibrium of various neighborhood systems. The spatial footprint of a ReGen village encompasses around 250,000 square meters, of which about 25 percent is allocated for buildings, including approximately 250–300 housing units. The remaining land is dedicated to diverse systems such as agriculture and food production, energy generation, and water management.
*(Reference: White Arkitekter & ReGen Villages. (2020). First Circular, Self-Sufficient Communities for Sweden. ArchDaily. )*

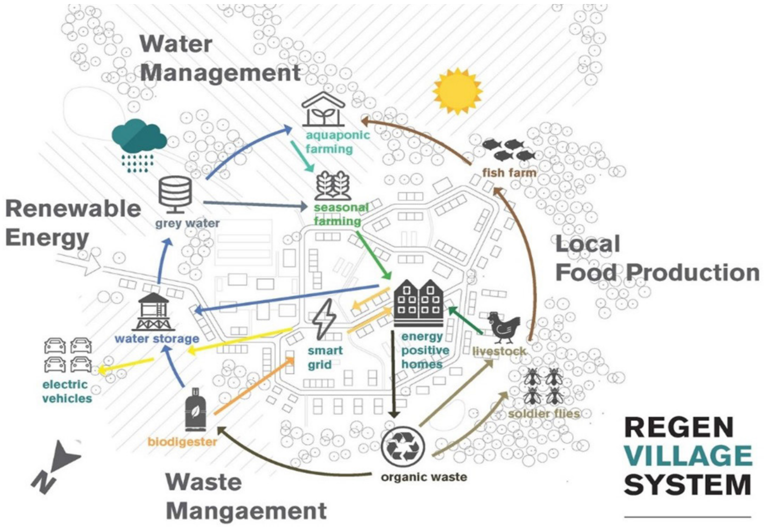



*Figure 10: REGEN Village system*
*Reference: White Arkitekter & ReGen Villages. (2020). First Circular, Self-Sufficient Communities for Sweden. ArchDaily.*

*Figure 11: Courtesy of White Arkitekter*
*Reference: White Arkitekter & ReGen Villages. (2020). First Circular, Self-Sufficient Communities for Sweden. ArchDaily.*

## 2. Innovative Self-Sustaining Village

Architects: EFFEKT
Location: Almere, The Netherlands
Collaborators: James Ehrlich, ReGen Villages, Holding B.V.
Area: 15500.0 m2
Project Year: 2016

Responding to some of the most critical global challenges encompassing environmental, social, and economic realms, a pioneering housing concept known as ReGen Villages (short for regenerative) has emerged. Spearheaded by Dutch holding firm ReGen Villages B.V. in collaboration with Copenhagen-based architecture firm EFFEKT, this groundbreaking model introduces self-sustaining communal neighborhoods that operate independently of traditional infrastructure and can be implemented worldwide.

At its core, this innovative approach accompany a range of cutting-edge technologies, including energy-positive dwellings, renewable energy systems, energy storage solutions, on-site organic food cultivation, vertical farming utilizing aquaponics and aeroponics, water management mechanisms, and waste-to-resource systems. Lynge, a spokesperson, elucidated, “ReGen Villages is all about applied technology. We are simply applying already existing technologies into an integrated community design, providing clean energy, water, and food right off your doorstep.”

In a world where roughly half the global population resides in urban areas, the efficiency and self-sufficiency offered by the ReGen systems could diminish the reliance on intensive urban living. This could initiate a fresh wave of peri-urbanism and rural advancement, enabling a more ecologically balanced distribution of populations across the planet’s expanse. Such dispersion would also reduce the pressure on local and national governments currently grappling with densely populated regions.

This strategic dispersal of population density nurtures “a model that not only enriches the environment and finances but also strengthen social bonds by fostering family empowerment and fostering a genuine sense of community, while also rekindling the relationship between human beings and the natural world, as well as the connection between consumption and production.” It stabilize a feeling of accomplishment, enhancing the appeal of this model’s long-term sustainability.
*(Reference: ArchDaily. (2016). Innovative Self-Sustaining Village Model Could Be the Future of Semi-Urban Living.)*

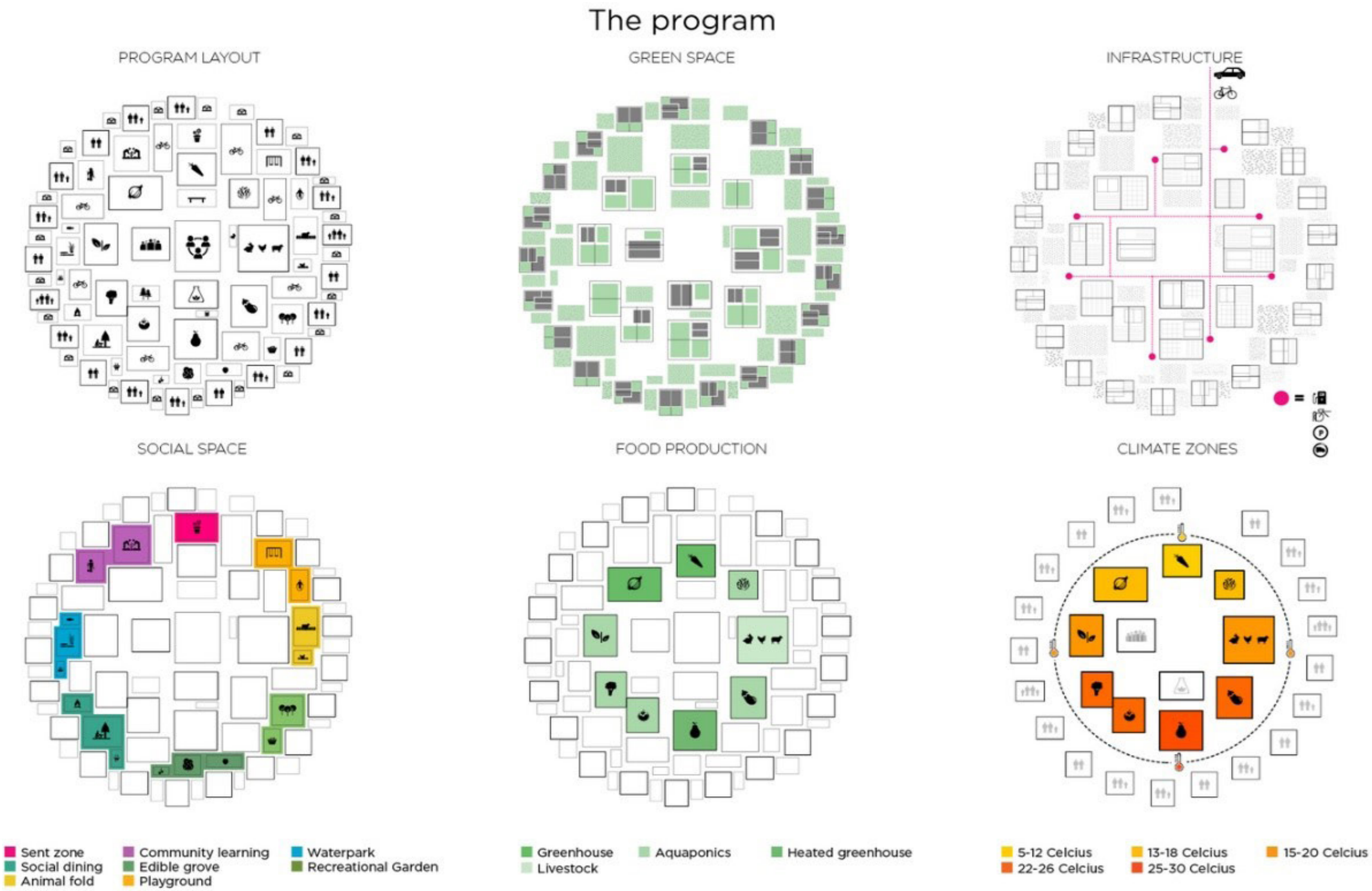



*Figure 12: Innovative Self-Sustaining Village Model program*
*Reference: ArchDaily. (2016). Innovative Self-Sustaining Village Model Could Be the Future of Semi-Urban Living*

## 3. A New Normal, Melbourne 2030

Shifting Melbourne's Role: From Consumer to Producer by 2030.

10 Key Profitable Initiatives Required to Transform Melbourne by 2030:

Electrifying Transportation: The era of the internal combustion engine is waning. Melbourne's transportation network will undergo a complete transition to electric vehicles.

Energy Storage: As the transition to 100% renewable energy gains momentum, effective energy storage systems are imperative to ensure reliable power availability.

Embracing Electric Architecture: A pivotal move involves severing the city's reliance on gas. The conversion of all existing structures to fully electric buildings is on the horizon.

Optimizing Building Efficiency: To effect significant energy reductions and mitigate greenhouse gas emissions, retrofitting existing buildings emerges as the most cost-efficient approach. Its implementation is poised to become obligatory.

Harnessing Solar Power: The aspiration is to adorn every alternate rooftop in Melbourne with solar panels, effectively tapping into the immense potential of solar energy.

Scaling Solar and Wind Grids: Victoria's LaTrobe Valley has the potential to rise post-coal by transforming into Australia's hub for renewable energy, leveraging solar and wind power.

Unlocking Water Potential: With water reserves projected to deplete by 2028, Melbourne is embarking on water treatment and reuse to address the impending scarcity.

Converting Organic Waste into Energy: Melbourne recognizes the inherent value in organic waste, which can be converted into both energy and fertilizers, contributing to sustainability and profit.

Phasing Out Landfills: The notion of landfills is approaching obsolescence, with a vision to prohibit the sale of products intended for disposal in landfills.

Pioneering Sustainable Architecture: Melbourne embraces the era of constructing environmentally neutral structures that are economically viable. This eco-conscious architectural approach is poised to become the norm.

Through these ten pivotal strategies, Melbourne is poised to transition into a self-sustaining producer, blazing a trail toward a more sustainable and prosperous future by 2030.*(In-text Citation: (Normalise, n.d.) Reference :Normalise. (2021). Retrieved from https://www.normalise.it/)*


*Figure 13: Greater Melbourne resource map*
*Reference: https://www.normal-ise.it/*

## 4. Vicente Guallart Wins Self-Sufficient City Competition for Post-Coronavirus China

Guallart Architects has won the international competition for the design of a mixed-use community in Xiong'an, China, defining an urban model that merges the traditional European urban blocks, the Chinese modern towers, and the productive farming landscape.
The forthcoming development, characterized by its innovative employment of mass timber and passive design techniques, is slated to consist of four blocks. This amalgamation will encompass a diverse program, spanning apartments, residences tailored for various age groups, office spaces, swimming pools, retail outlets, food markets, a kindergarten, an administrative hub, and even a fire station, among an array of other amenities.

All buildings will be covered by greenhouses that will allow them to produce food for daily consumption and use their sloping roofs to produce energy. In the ground floor, small co-working digital factories will allow to use 3D printer and rapid prototyping machines to produce object for the daily use. So the building will have an internal metabolic system that will integrate energy production, recycled water, food production and material reuse promoting a distributed model for urban management.
(*Reference : ArchDaily (2020). Vicente Guallart Wins Self-Sufficient City Competition for Post-Coronavirus China.)*

***,, We developed this project during confinement, when the entire team worked from home and we decided to include all those aspectsthat could make ourlives better, so that a new standard could be defined. ,,***

*(Reference : ArchDaily (2020). Vicente Guallart Wins Self-Sufficient City Competition for Post-Coronavirus China. )*

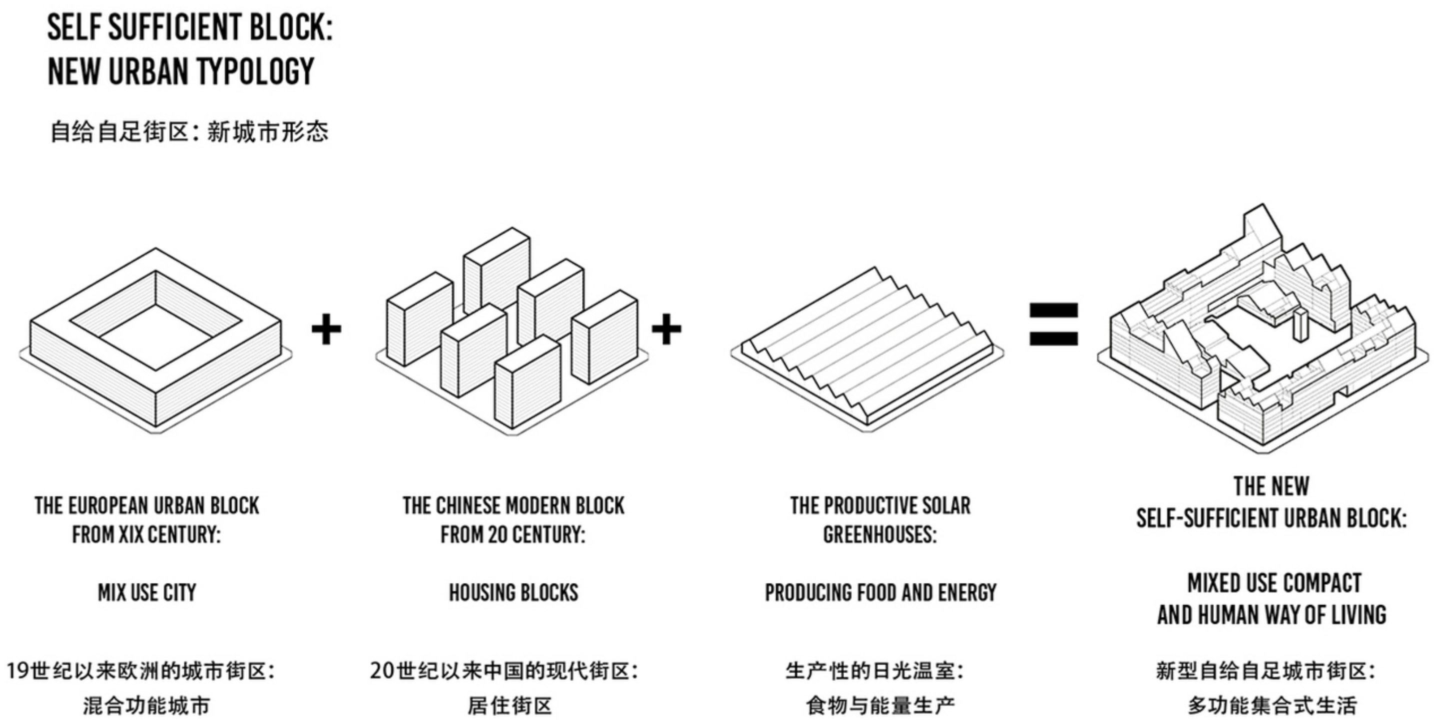



*Figure 14: Vicente Guallart Wins Self-Sufficient City Competition for Post-Coronavirus China*
*Reference : ArchDaily (2020). Vicente Guallart Wins Self-Sufficient City Competition for Post-Coronavirus China.*

## 5. XZero City is Kuwait's Proposal for a Self-Sufficient Smart City

Kuwait is planning a 1,600-hectare development that will provide residential units, jobs, and amenities for 100,000 residents. Developed by URB, the ambitious project aims to promote a sustainable lifestyle with high standards of living, yet a low impact on the environment. The masterplan for the smart city is designed to optimize density and amenities distribution to create a walkable city, while also optimizing the green space ratio. This will help mitigate the effects of rising temperatures and the urban heat island effect. The green transportation systems and dedicated cycling tracks will make this a car-free city, apart from a ring road that allows for limited vehicular access. The city also promotes a circular economy that aims to provide food and energy security for the residents.

This comprehensive strategy strategically addresses the fundamental triad of sustainability: the social, economic, and environmental dimensions. Thoughtful decisions regarding aspects such as building orientation, density, and structure were methodically woven into the blueprint's fabric from its inception, facilitating a reduction in energy demands while requiring a judicious financial investment. The meticulous optimization of the project was carried out through the integration of diverse digital tools, including energy modeling and microclimate analyses.

At a building level, sensors play a key role. Indoor lighting and temperature can automatically be adjusted based on various parameters. These include the number of occupants in a room, the time of day as well as exterior weather and light conditions. All systems are aimed at reducing consumption while not lowering the standard of living.
*(Reference: ArchDaily. (2022.). XZero City: Kuwait's Proposal for a Self-Sufficient Smart City.)*

***,, The heart of this project is the unique resilient landscape, which is multifunctional and designed to promote health, wellbeing & biodiversity. The landscape is the social glue to the entire city, which will enable a vibrant neighborhood while connecting residents to all amenities within minutes. The landscape promotes a variety of habitats for wildlife. ,,*** *(Baharash Bagherian, CEO of URB)*

*(Reference: ArchDaily. (2022.). XZero City: Kuwait's Proposal for a Self-Sufficient Smart City.)*

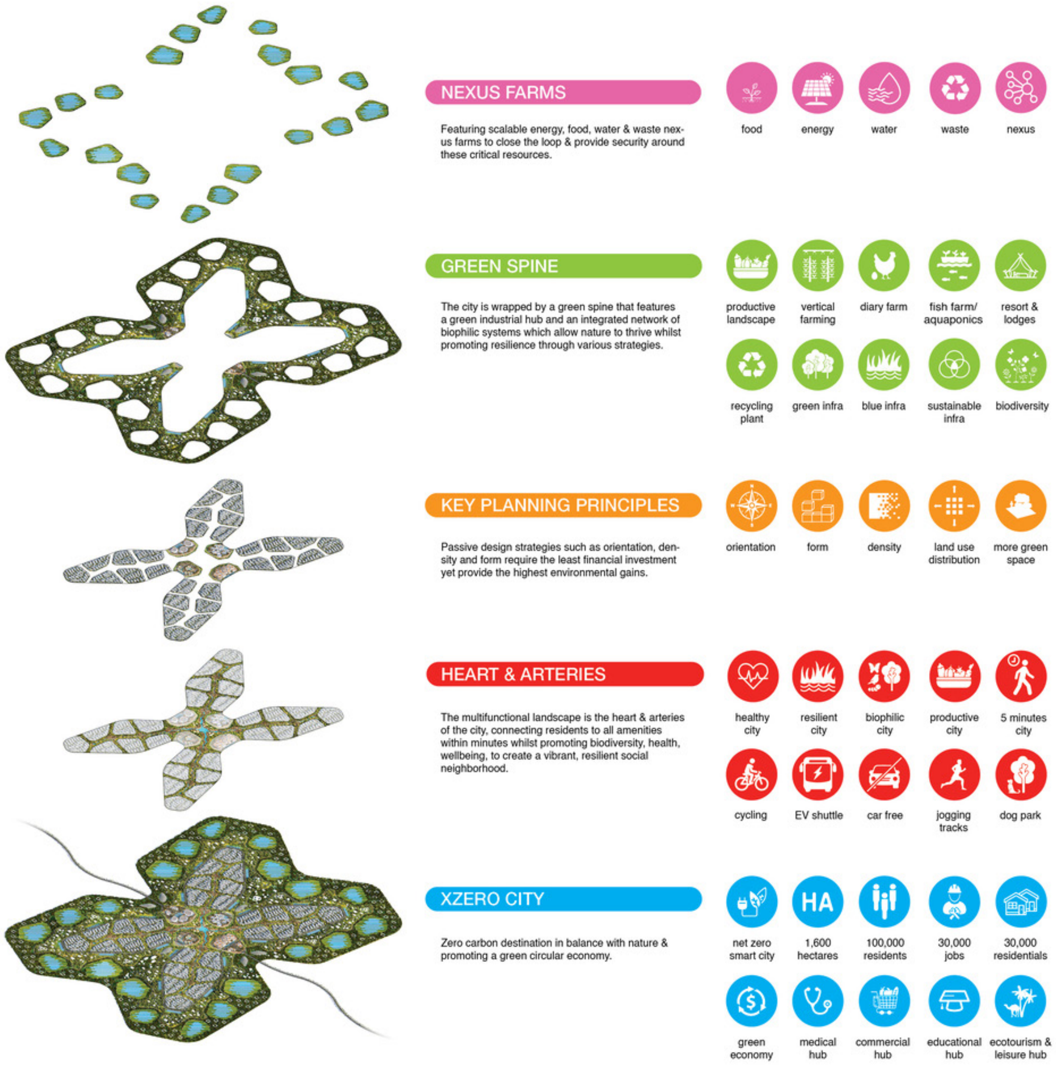



*Figure 15: XZero City is Kuwait's Proposal for a Self-Sufficient Smart City Courtesy of URB*
*Reference: ArchDaily. (2022.). XZero City: Kuwait's Proposal for a Self-Sufficient Smart City.*

## 6. MVRDV Unveils its Vision for a Self-Sufficient Valley in Armenia

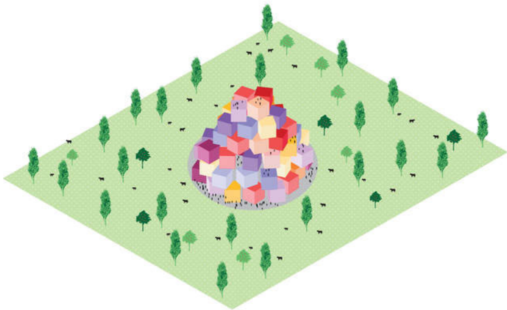
MVRDV has been commissioned by the Armenian non-profit organization DAR Foundation for Regional Development and Competitiveness to develop a masterplan that will transform Gagarin Valley's 34,000-hectare area into a more sustainable and ecologically diverse land. With the help of over 10,000 plant species, innovative facilities, and additional 12,000 housing units, the valley is set to become an ideal community for sustainable agriculture and ecotourism.
Around 11,000 inhabitants are spread across the valley, living on a unique topography that consists of different pieces of land. The first step towards developing the design was to embrace the site's mosaic of 10,000 existing plots. With that, the team preserved and reinforced the patches, and improved the water system by lining the boundaries between them with new canals and public paths, and by restoring and enlarging the Hrazdan River route to irrigate farmland and preserve water.

To maximize the potential of the valley, MVRDV infused a spectrum of facilities into the landscape, thereby transforming it into a multifaceted domain primed for sustainable agriculture and habitation. The valley will witness the integration of existing roads, augmented by newly introduced pedestrian and cycling paths, interlinking diverse villages. The refurbishment of aged structures, originally constructed during the Soviet era, will transpire to curtail material wastage. The design of these rejuvenated buildings takes inspiration from traditional Armenian farmhouses, incorporating green roofs to heighten the valley's allure for various demographic groups.

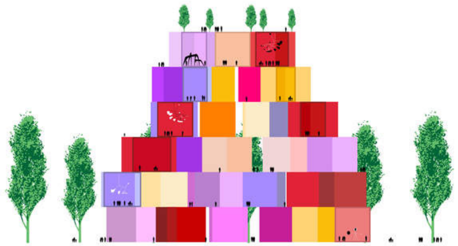
Aligned with the Armenian government's aspirations, financial backing is envisaged to be channeled towards fostering sustainable agriculture and promoting tourism within the valley. By the year 2026, the nation's goal is to attract approximately 2.5 million tourists annually, a feat made feasible by the metamorphosis of Gagarin Valley into a compelling destination.

*(Reference: ArchDaily. (2022). MVRDV Unveils its Vision for a Self-Sufficient Valley in Armenia.)*

## Art Center



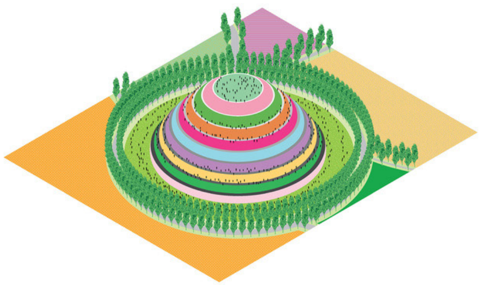
Building Axo



Building section

*Figure 16: MVRDV Unveils its Vision for a Self-Sufficient Valley in Armenia, Art centre*
*Reference: ArchDaily. (2022). MVRDV Unveils its Vision for a Self-Sufficient Valley in Armenia.*

## Food Market



Building Axo

Building section

*Figure 17: MVRDV Unveils its Vision for a Self-Sufficient Valley in Armenia, Food Market*
*Reference: ArchDaily. (2022). MVRDV Unveils its Vision for a Self-Sufficient Valley in Armenia.*

## 7. SOM to Design Convertible Self-Sufficient Milan-Cortina Olympic Village

Skidmore, Owings & Merrill was selected to design the Olympic Village for the 2026 Milan-Cortina Olympics following an international competition of 71 architecture studios from nine different countries. The project is part of the updated Porta Romana Railway Yard Master Plan, and will create a new center of activity in Porta Romana with minimal environmental impact. The self-sufficient project will feature residential, commercial, and public spaces, that change configurations based on the Olympics event.

The Olympic Village will transform the Porta Romana district into a community-centered urban hub, offering a powerful new model for facilities to serve post-Olympic social projects. The project includes public green spaces, a transformation of two historic structures, and six new residential buildings that will house Olympic athletes temporarily. Following the Olympics, the athletes' homes will be used as student housing, the park and railway side buildings will be reused as affordable housing, and the Olympic Village Plaza will become a public square, with commercial spaces, outdoor markets, and hospitality facilities.

The village will comply with NZEB (Nearly Zero Energy Building) requirements to ensure ecological consciousness. The project provides passive cooling strategies, solar panels, and rooftop gardens that ensure that more than 30% of the energy will be produced on site. Storm water will also be collected on site and reused. The new buildings employ sustainable materials, such as mass timber structure for the residential buildings, and low-embodied carbon for the facade materials. *(Reference: Skidmore, Owings & Merrill. (2021). Olympic Village Design for 2026 Milan-Cortina Olympics. )*

> ***„ Rather than ceasing to be of use after the Olympics, the Porta Romana Olympic Village will ultimately become a vibrant, self-sustaining neighborhood built around the principles of social equity, environmental commitment, wellness, and inclusivity. The village adopts the rhythm of the area's streetscape, creating a porous urban block with a variety of public spaces and communal anchors that will enhance Milan's vibrant tapestry of ground floor experiences. -- „***
> *Colin Koop, SOM Design Partner*
> *(Reference: Skidmore, Owings & Merrill. (2021). Olympic Village Design for 2026 Milan-Cortina Olympics.)*

*Figure 18: SOM to Design Convertible Self-Sufficient Milan-Cortina Olympic Village*
*Reference: Skidmore, Owings & Merrill. (2021). Olympic Village Design for 2026 Milan-Cortina Olympics.*

## 8. Net-Zero Campus on Governors Island, New York City

Situated on Governors Island, New York, the novel net-zero campus is poised to establish itself as a foundational institution for the advancement of innovative climate solutions. Pioneering a unique global initiative, known as "The Exchange," this venture also stands as a pivotal regional center driving the green economy.

With its sights set on setting a paradigm for sustainability, the new campus employs energy-positive design strategies. These strategies encompass the utilization of mass timber construction, on-site solar power generation, and the seamless integration of existing structures, all converging to achieve a net-zero energy campus. The architectural blueprint seamlessly melds with the island's natural landscape, forming a harmonious union between human creativity and the environment. The outcome is a dynamic living laboratory catering to research, education, and public engagement. As part of its mission, the campus is slated to facilitate green job training and skill development programs for local residents, while fostering collaborative partnerships with neighboring research institutions like Pratt Institute and New York University.

Spanning 400,000 square feet of constructed space, the site is thoughtfully designed to encompass an interactive living laboratory. This space will house diverse components including research laboratories, classrooms, exhibition areas, greenhouses, mitigation technologies, and residential facilities. Integral to the design is the Research and Technology Accelerator, a nurturing ground for ideas and initiatives dedicated to confronting the challenges of climate change.

In terms of environmental stewardship, the project aspires to earn True Zero Waste certification, effectively diverting a substantial 95% of waste away from landfills. Water resource management is also integral, with plans to fulfill 100% of non-potable water needs through rainwater harvesting and treated wastewater. Moreover, the site is engineered to rely exclusively on solar-generated electricity produced on-site, with the ambitious goal of generating a surplus of energy to contribute to the city's power grid. *(Reference: ArchDaily. (2023). SOM Reveals Design for a Net-Zero Campus on Governors Island, New York City.)*

> ***„ Our design for this new campus embodies the stewardship necessary to solve the climate crisis by weaving sinuous mass timber pavilions through the rolling landscape of the park and reusing the historic building fabric of Governors Island. Together, these spaces will cultivate advances in climate research and pilot new technologies that can be deployed across the city, and, eventually, the world.***
>
> *- „ SOM Design Partner Colin Koop*
>
> *(Reference: ArchDaily. (2023). SOM Reveals Design for a Net-Zero Campus on Governors Island, New York City.)*

*Figure 19: Net-Zero Campus on Governors Island, New York City*
*Reference: ArchDaily. (2023). SOM Reveals Design for a Net-Zero Campus on Governors Island, New York City.*

## 9. vauban neighbourhood, Freiburg (Germany)

The model district Vauban is now known throughout the country as an environmentally conscious and family-friendly district. New forms of civic involvement and collective building are further characteristics of the traffic-calmed residential area. Individually designed housing forms show that sustainable living can be colorful and diverse. Passive construction, energy-plus construction and the use of solar technology are standard.
All buildings must meet minimum low energy consumption standards of 65 kWh/m2a (i.e., at least half the average German energy standards). Public energy and heat are generated by a highly efficient woodchip-powered combined heat and power generator connected to a district heating grid. 42 building units are of the Passivhaus standard, consuming under 15 kWh/m2a. 100 houses adhere to a “plus-energy” standard, producing more energy than they use, with surpluses sold back to the city grid and profits split between each household.
Importantly, the project is being monitored using lifecycle and regional material flow analysis with the GEMIS software. This is the first time that a complete urban neighbourhood has been analysed with respect to buildings, infrastructure, electricity supply, heat supply, water and waste, traffic and private consumption with a full life-cycle perspective and using regional data. The gathering of local data was possible for all areas except private consumption, for which national average data was used. Through this, the following provisional figures have been developed:

1. Annual Energy Savings: 28 GJ (calculated as “CER,” cumulative energy requirements).
2. Yearly Reduction of CO2-Equivalents: 2100 tons.
3. Annual Diminution of Sulphur Dioxide (SO2) Equivalents: 4 tons.
4. Annual Conservation of Mineral Resources: 1600 tons.

*Reference: (David Thorpe, 2023)*

***“The Vauban district was created through cooperative decision-making, becoming a model of holistic environmental planning and eco-friendly living,” (****Louise Abellard writes.)*

*Reference: (David Thorpe, 2023)*

*Figure 20: vauban neighbourhood, Freiburg (Germany)*
*Reference: mart Cities Dive. (2023). The World's Most Successful Model for Sustainable Urban Development*

## 10. BedZED (BEDDINGTON ZERO ENERGY DEVELOPMENT)

Site Location: SANDMARTIN WAY, WALLINGTON, ENGLAND, UK
Project Date: 2002

BedZED (Beddington Zero Energy Development) is the UK's largest eco-village, a mixed housing and work space development located in Beddington, London Borough of Sutton. Initiated by BioRegional and designed and constructed by a team of the architect Bill Dunster, BioRegional, Peabody Trust and Arup, BedZED embraces all aspects of sustainable design with 100 experimental homes, community facilities and workspace for 100 people (1600 m2 of workspace) and offers many eco-living amenities.

According to the BedZED website, "It is the first large-scale 'carbon neutral' community – i.e. the first not to add to the amount of carbon dioxide in the atmosphere, and is an excellent example of creative use of brownfield land…The design is to a very high standard and is used to enhance the environmental dimensions, with strong emphasis on roof gardens, sunlight, solar energy, reduction of energy consumption and waste water recycling."

Some of the BedZED features include multicolored wind funnels, or wind cowls – which provide passive ventilation – sustainable building, materials, low energy appliances and fixtures, a residents-only car pool, and every part of the roofscape is used for passive solar, PV's, roof gardens or extensive Sedum coir mats.
Flat roofs have been used to provide private gardens where 300mm of soil has been covered with turf (but owners or tenants are free to grow whatever they wish). The extensive greenroof has been limited to the remaining (mainly north facing) areas. Sedum roofs are covered in semi-succulent plants that absorb rainfall and decrease the amount of rainwater that can be harvested.
(*Reference: Reference: ZEDfactory. (2023). BedZED.)*

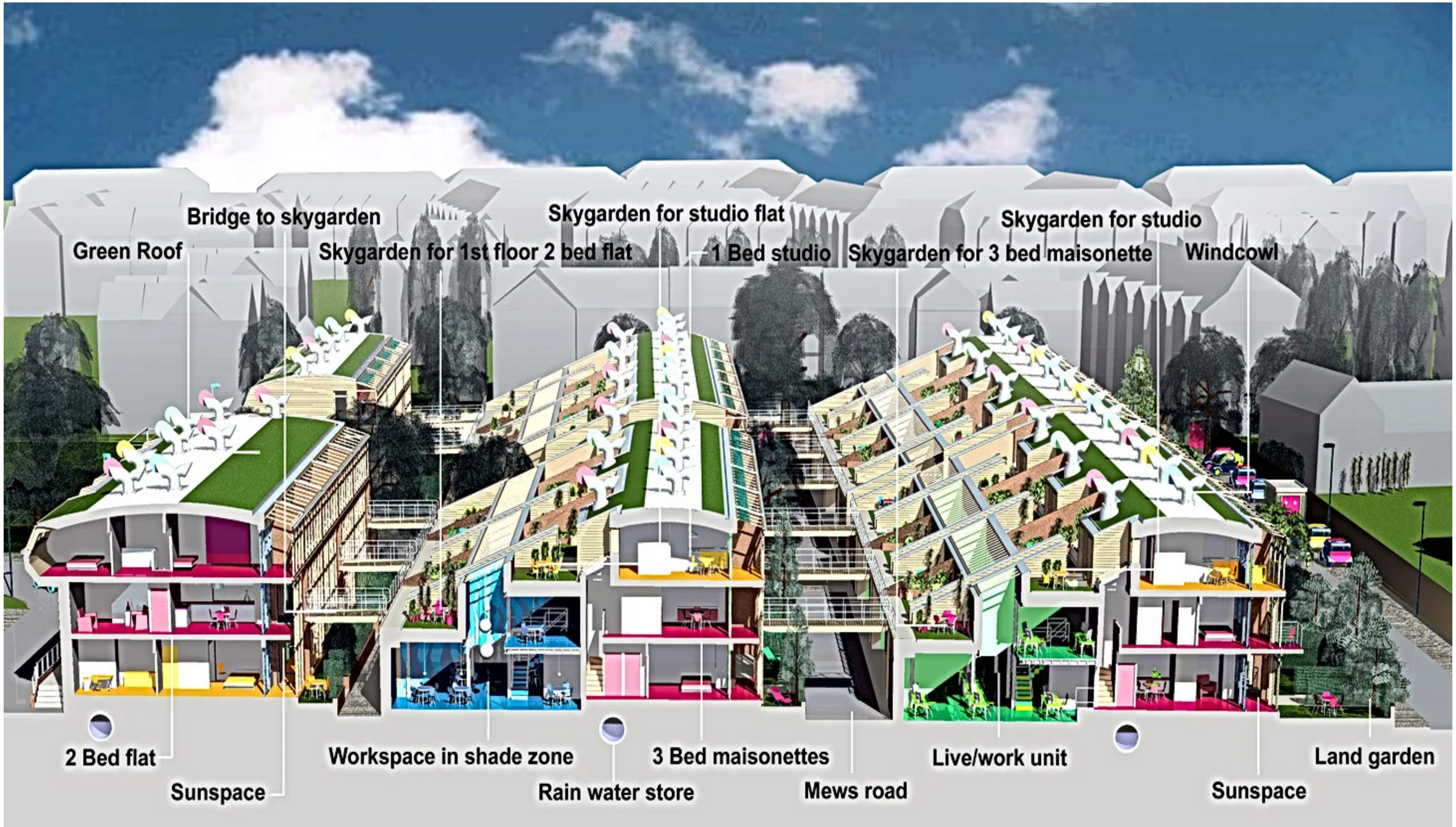



*Figure 21: BedZED Sectional Perspective*
*Reference: Reference: ZEDfactory. (2023). BedZED.*

## 11. CityWave Urban Regeneration Project in Milan

Construction has officially commenced on Bjarke Ingels Group's (BIG) gateway project for Milan's CityLife district. This innovative office building, representing the culmination of the CityLife area's revitalization in the Italian city, embodies a commitment to sustainability, enhanced quality of life, and comprehensive services. The structure is envisioned to serve as a pioneering model for future workplaces, embodying inventive design solutions that prioritize quality of life and redefine sustainability principles.

In 2019, BIG introduced their design for The Portico, a sprawling 53,500-square-meter development on the final two available plots within CityLife. This proposal comprises two distinct buildings, East and West, interconnected by a 140-meter suspended roof structure, creating a grand urban-scale entrance to the city. All levels across both buildings benefit from generously high three-meter ceilings, welcoming abundant natural light through their glass facades.

The West building is designed with two underground levels, a lower ground floor, and twenty-one above-ground floors. Seventeen of these levels will serve as office spaces, while the remaining three are designated for a restaurant and sky bar, with the final floor fulfilling technical requirements. The ground floor will house shared amenities and a central auditorium. The building's concept emphasizes a relationship between floors, as evidenced by a sculptural staircase connecting the initial five floors and a visual linkage for the subsequent levels beneath the roof.

Meanwhile, the East building encompasses two underground levels, a lower ground floor, and eleven above-ground floors. The ground and first floors will feature an atrium with a winter garden and shared facilities. The interior design of this tower similarly revolves around relationships, with a monolithic staircase uniting the first two floors and visual connections created through the atrium and balconies encircling the inner courtyard.

A distinctive feature of this project is its commitment to achieving a "zero impact" beyond conventional standards by relying solely on renewable energy sources. Both towers will be enveloped in photovoltaic panels, rendering the endeavor one of Italy's largest urban photovoltaic parks. This system also facilitates rainwater collection and reuse, in addition to offering extensive covered public green spaces. With environmentally conscious solutions like thermal groundwater utilization, the building is engineered to consume 45% less energy than conventional office spaces.
(*Reference: ArchDaily. (2021). Construction Begins on BIG's CityWave Urban Regeneration Project in Milan.)*


*Figure 22: CityWave Urban Regeneration Project in Milan*
*Reference: ArchDaily. (2021). Construction Begins on BIG's CityWave Urban Regeneration Project in Milan.*

## Comparison of case studies: indicators and outcomes

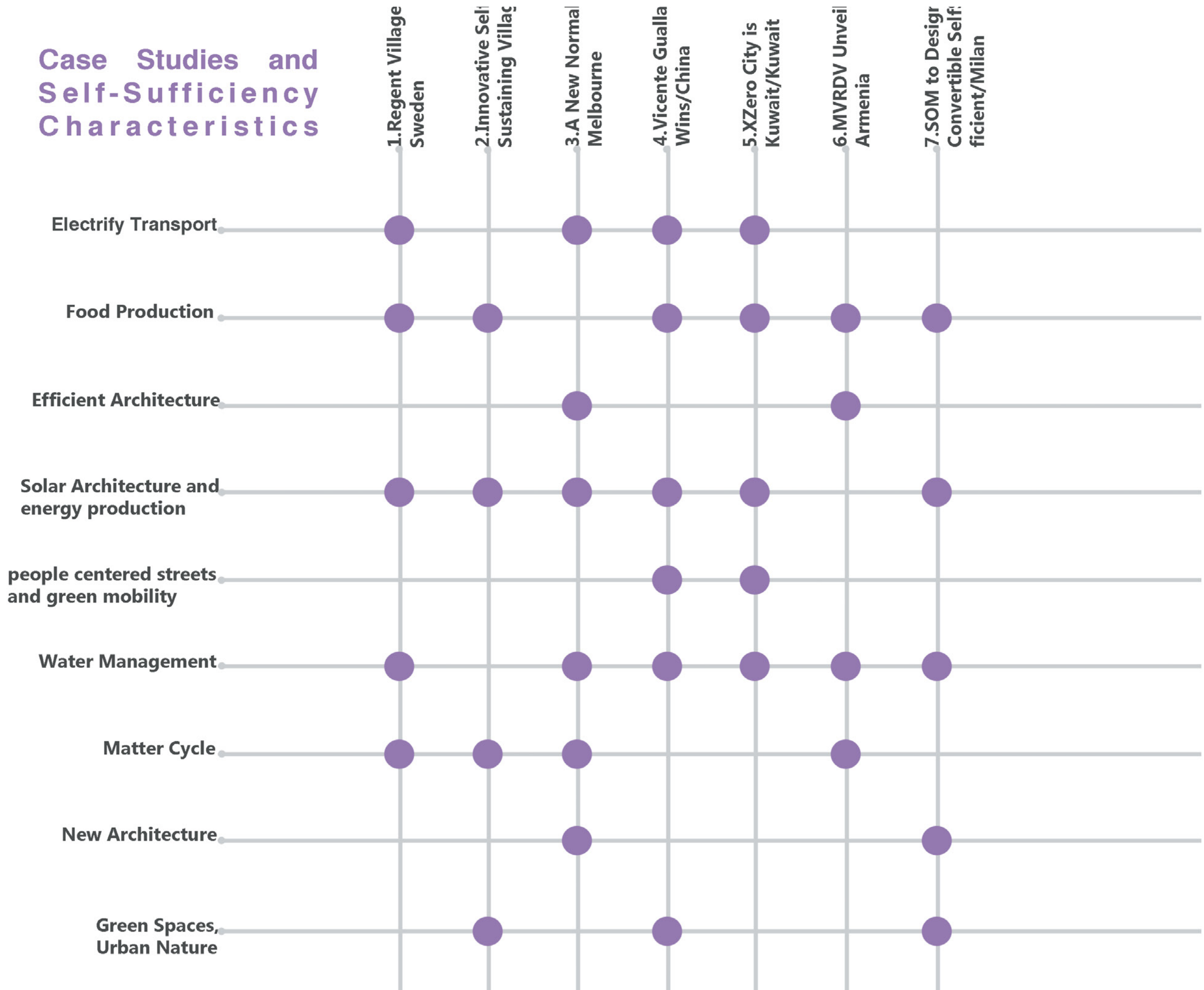



*Figure 23: Comparison of case studies in self sufficient characteristics*
*Reference: Author*

| How each case study responded to each criteria | Electrify Transport | Food Production | Efficient Architecture | Solar Architecture and energy production | People-centered streets and green mobility | Water Management | Matter Cycle | New Architecture | Green Spaces, Urban Nature | Facility |
|---|---|---|---|---|---|---|---|---|---|---|
| **1.Regent Villages/ Sweden** | Electric Vehicles | 1. Vertical Farming,<br>2. Fish Farming,<br>3. Livestock,<br>4. Seasonal Farming,<br>5. Aquaponic Farming | | Solar Panel Power | | 1.grey water,<br>2.Water Storage | 1.Organic Waste separation,<br>2.Biodigester | | | |
| **2.Innovative Self-Sustaining Village Netherlands** | | 1. Vertical Farming,<br>2. Aquaponic Farming | | Solar Panel Power | | | waste-to-resource systems | | Vertical green spaces | 1.Playground,<br>2. Social dining,<br>3. Recreational Garden,<br>4. community learning |
| **3.A New Normal/Melbourne 2030** | Convert cars to electric | | Mandate the retrofit of all existing buildings | Solar Panel Power | | 1.Treat and reuse sewer water within the city,<br>2.Increase the permeability of our suburban streets,<br>3. Decentralized water treatment plants distributed throughout the city | Install anaerobic digesters throughout the city to convert organic waste into energy and fertilizer | construct profitable buildings with no negative environmental impact. It must become the industry standard. | | |
| **4.Vicente Guallart Wins/China** | 1. Electric taxi<br>2. car sharing<br>3. battery charging | 1. fruit orchards<br>2. vertical LED farming<br>3. roof top farming<br>4. greenhouses<br>5. balcony kitchen garden<br>6. medicinal plants<br>7. edible forest<br>8. aeroponic<br>9. hydroponics | | Solar Panel Power | 1. cycling path<br>2. pedestrian path<br>3. public transport<br>4. Drone delivery | 1. recycled water<br>2. storm water retained and infiltrated | | Only recyclable construction materials | 1. living wall<br>2. green roof coverage<br>3. bird box in each apartment | 1. fab labs<br>2. teleworking<br>3. startup hubs<br>4. conventional office<br>5. coworking<br>6. residences for young and old people<br>7. swimming pools<br>8. shops<br>9. food markets<br>10. kindergarten<br>11. an administrative center<br>12. a fire station |
| **5.XZero City is Kuwait/Kuwait** | green transportation systems and dedicated cycling tracks, EV Shuttle | multiple farming methods such as community gardens,<br>1. bio-domes,<br>2. aquaponics,<br>3. vertical farms,<br>4. bio saline agriculture. | | Solar Panel Power | car-free city, apart from a ring road that allows for limited vehicular access. | 1.rainwater collection,<br>2. flood mitigation | | | | 1. 5 minutes city,<br>2.dog park,<br>3. jogging tracks,<br>4. medical hub,<br>5. commercial hub,<br>6. educational hub,<br>7.eco-tourism,<br>8. Leisure hub |
| **6.MVRDV Unveils/Armenia** | | formed by a spherical educational agricultural center surrounded by houses that form vertical villages. | Old buildings will be entirely renovated to limit the waste of building materials. | | | lining the boundaries between new canals and public paths, and by restoring and enlarging the Hrazdan River route to irrigate farmland and preserve water. | limit the waste of building materials | | | connect different villages together, serving as a sought-after destination for people to walk, hike, cycle, and ride horses |
| **7.SOM to Design Convertible Self-Sufficient/Milan** | | urban farms that allow for on-site food production | | Solar Panel Power | | Storm water collection | | The new buildings employ sustainable materials, such as mass timber structure for the residential buildings, and low-embodied carbon for the facade materials. | 1.public green spaces<br>2. Vertical greenery | 1.Student housing,<br>2.Commercial spaces,<br>3. public square,<br>4. outdoor market,<br>5. hospitality facilities |
| **Conclusion** | 1. Electric taxi<br>2. car sharing<br>3. battery charging | 1. Vertical Farming,<br>2. Fish Farming,<br>3. Aquaponic Farming<br>4. roof top farming<br>5. greenhouses<br>6. aeroponic<br>7. hydroponics | 1. Mandate the retrofit of all existing buildings<br>2. limit the waste of building materials. | Solar Panel Power | 1. cycling path<br>2. pedestrian path<br>3. public transport<br>4. car-free city | 1.rainwater collection,<br>2. flood mitigation | 1.Organic Waste separation,<br>2.Biodigester<br>3. limit the waste of building materials | Only recyclable construction materials | 1. living wall<br>2. green roof coverage<br>3. bird box in each apartment<br>4.public green spaces | 1.Student housing,<br>2.Commercial spaces,<br>3. public square,<br>4. outdoor market,<br>5. hospitality facilities<br>6.dog park,<br>7. jogging tracks,<br>8. medical hub,<br>9. educational hub,<br>10.eco-tourism,<br>11. Leisure hub<br>12. food markets<br>13. kindergarten<br>14. teleworking<br>15. conventional office<br>16. coworking<br>17. residences for young and old people<br>18. swimming pools<br>19.Playground |

*Table 1: Comparison of case studies in self sufficient characteristics in detail*
*Reference: Author*

## Challenges and lessons learned from these case studies

The examined case studies reveal common challenges and offer valuable lessons that can guide the development of self-sufficient neighborhoods and mixed-use architecture:

Challenges:

1. Balancing energy-efficient infrastructure with sustainable transportation solutions.
2. Implementing circular economy practices to minimize waste and resource depletion.
3. Integrating green spaces and renewable energy sources in urban settings.
4. Achieving carbon-neutrality and resource conservation in resource-scarce environments.
5. Balancing agroecology, renewable energy, and rural-urban integration.
6. Designing adaptable spaces while maintaining self-sustaining systems.
7. Embedding sustainable practices in educational institutions and fostering environmental awareness.
8. Encouraging sustainable transportation and passive solar design in car-free zones.
9. Combining passive solar design, sustainable transportation, and low-carbon development.
10. Implementing smart mobility solutions for urban revitalization and green infrastructure.

Lessons Learned:

1. Local community involvement and engagement are essential for self-sufficiency.
2. Circular systems and resource-efficient practices can reduce dependency on external resources.
3. Prioritizing clean energy sources and water conservation supports self-sufficiency.
4. Environmental education and green technologies promote self-sufficiency in education.
5. Sustainable transportation and passive solar design enhance urban self-sufficiency.
6. Mixed-use architecture fosters diverse functions, enhancing community self-sufficiency.
7. Low-carbon development and energy-efficient buildings are key to sustainability.
8. Smart infrastructure and renewable energy sources drive urban self-sufficiency.
9. Mixed-use buildings integrate various functions within a single structure, promoting resource sharing.
10. They enhance self-sufficiency by reducing the need for travel, thus minimizing carbon footprint.
11. Mixed-use architecture supports circular economy practices through efficient use of space.
12. Adaptive designs in mixed-use buildings respond to changing community needs and resource availability.
13. Incorporating commercial, residential, and communal spaces within mixed-use buildings fosters community engagement and shared sustainability practices.
14. Mixed-use buildings contribute to local resilience by accommodating diverse functions and services in proximity.

## Case Study Significance for Self-Sufficient Neighborhoods and Mixed-Use Architecture

These case studies hold profound significance for the thesis exploring self-sufficient neighborhoods and mixed-use architecture. The concept of self-sufficiency transcends the mere provision of basic needs; it encompasses a holistic approach to urban living, emphasizing harmonious integration with the natural environment, resource conservation, and community well-being. Through the lens of mixed-use architecture, these case studies underscore the transformative potential of designing spaces that serve multiple functions, fostering dynamic and vibrant neighborhoods that thrive on diversity.

Take, for instance, the “Innovative Self-Sustaining Village” in the Netherlands. This case study showcases a circular economy approach, highlighting how various waste streams can be converted into valuable resources, thus reducing the strain on external supply chains. This not only addresses resource scarcity but also diminishes the environmental impacts associated with waste disposal. Such circular systems are fundamental to achieving self-sufficiency by closing resource loops and promoting regenerative practices.

Furthermore, the “Net-Zero Campus” in New York City demonstrates the pivotal role of educational institutions in driving sustainable change. By integrating green technologies, energy-efficient buildings, and environmental education, the campus serves as a living laboratory for sustainable practices. This case study reveals how mixed-use architecture can contribute to self-sufficient neighborhoods by embedding sustainable behaviors within educational spaces, ultimately fostering a culture of environmental responsibility among future generations.

In examining these case studies collectively, it becomes evident that the pursuit of self-sufficiency is not limited to a single approach. Rather, it requires a harmonious fusion of architectural innovation, technological advancement, community engagement, and policy support. Self-sufficient neighborhoods thrive when residents actively participate in resource management, as exemplified by the “Self-Sufficient Valley” in Armenia. This case study emphasizes the importance of integrating local agriculture, renewable energy, and eco-friendly housing to create a self-sustaining ecosystem, rooted in community collaboration.

In conclusion, the case studies presented in this table illuminate the multifaceted nature of self-sufficient neighborhoods and mixed-use architecture. They illustrate how various elements, from renewable energy integration to circular economy practices, contribute to the creation of urban spaces that are economically resilient, ecologically responsible, and socially inclusive. These case studies collectively offer a comprehensive exploration of innovative strategies and solutions that hold immense promise for transforming urban landscapes into self-sufficient havens of sustainability. Through their diverse approaches and lessons, they provide a rich foundation for the thesis’s exploration of the potential, challenges, and opportunities inherent in self-sufficient neighborhoods and mixed-use architecture.

| Case Study Name | Location | Approach /Concept | Key Features | Sustainable Elements | Response to Self-Sufficiency Challenges |
|---|---|---|---|---|---|
| Self-Sufficient Communities | Sweden | Eco-friendly neighbourhoods | Renewable energy, waste recycling, local food production | Energy-efficient buildings, sustainable transport | Local energy production, waste management through recycling, local food production |
| Innovative Self-Sustaining Village | Netherlands | Circular economy principles | Solar energy, rainwater harvesting, sustainable architecture. | Circular economy practices, waste reduction | Closed-loop systems for waste, energy, and water, promoting resource self-sufficiency |
| A New Normal | Melbourne | Urban resilience | Green spaces, renewable energy, community engagement | Sustainable urban planning, climate adaptation | Resilient urban planning, incorporating renewable energy and green spaces |
| Vicente Guallart Wins | China | Smart city design | IoT integration, self-sufficiency in energy and resources | Smart technology integration, innovative urban solutions | Integration of IoT for energy optimization, resource monitoring for self-sufficiency |
| X Zero City is Kuwait | Kuwait | Carbon-neutral city | Clean energy sources, water conservation, sustainable transportation | Carbon-neutral infrastructure, renewable energy | Focusing on renewable energy generation, efficient water use for self-sufficiency |
| Self-Sufficient Valley | Armenia | Sustainable development | Agroecology, renewable energy, eco-friendly housing | Rural-urban integration, community involvement | Localized agriculture, renewable energy, community engagement for self-sufficiency |

| | | | | | |
|---|---|---|---|---|---|
| Design Convertible Self-Sufficient | Milan | Adaptive architecture | Flexible spaces, renewable energy, self-sustaining systems | adaptable infrastructure | renewable energy integration |
| Net-Zero Campus | New York City | Sustainable education | Energy-efficient buildings, green technology integration | Renewable energy, waste reduction, environmental education | Incorporating energy-efficient design and waste reduction strategies for self-sufficiency |
| Vauban Neighbourhood | Germany | Eco-friendly community | Car-free zone, renewable energy, passive solar design | Sustainable transport, green spaces, energy-efficient buildings | Encouraging sustainable transportation, communal green spaces for self-sufficiency |
| BedZED | England | Low-carbon development | Passive solar design, renewable energy, sustainable materials | Sustainable transportation, zero-energy buildings | Eco-friendly transportation options, energy-efficient buildings for self-sufficiency |
| City Wave | Milan | Sustainable innovation | Smart mobility solutions, renewable energy sources | Urban revitalization, smart mobility, green infrastructure | Integrating smart mobility and renewable energy sources for self-sufficiency |

*Table 2: summary of case studies*
*Reference: Author*

# Chapter Four

# **Urban Scale Design**

## **Turin district block**


*Illustrations: Ana María Ospina*

## Self-sufficient districts in Italy and Turin: background and overview

The case that is examined in this thesis, with a preliminary project proposal that we will see in Chapter 4, is located in the city of Turin and, in particular, in the urban area called “Quartiere Spina 3”.

This choice is due to two main reasons. The first is that the neighbourhood owes its name to the urban transformation that defined it with the 1995 urban master plan ( Piano Regolatore Generale Comunale ). Spina 3 was one of the strategic areas of transformation which, in part, has been put into practice. The second reason concerns the centrality that the theme of “self-sufficient communities” has in this area due both to the high residential and building density and to the priority that the themes specifically treated in Chapter 2 have in this area and, in particular to the current priority which in this area today have both the issues related to the NZED and the strengthening of accessibility to local services resulting from today’s needs that have emerged after the lockdown period
It should also be underlined that the 1995 urban plan already had among its priorities that “....‘urban transformation areas’ were
designated to regulate the reuse of brownfield sites and solve the problem of ‘urban voids’ ...(i)...to create place oriented policies ...” ( Barosio, Eynard, Marietta, Marra, Melis, Tabasso, 2016, Journal of Urban Regeneration Renewal Vol 9 N 4:367 - 380) (add also in final bibliography). On this topic and, in particular, on the transformations of the specific “Spine 1,2,3,4” of the Turin Urban Plan there is also an accurate and in-depth specific bibliography.

Spina 3, also known as Quartiere Spina 3, is a significant urban transformation project in Turin, Italy. This area, spanning about one million square meters, was previously occupied by industrial sites, including the Ferriere Fiat iron metallurgy plant, Michelin tire factory, Savigliano electrical and railway goods manufacturing, and Paracchi carpet factory. These industries played a vital role in Turin’s industrial history but were disbanded in the late 20th century, resulting in the loss of thousands of jobs.
The transformation of Spina 3 began with the closure of these industries, and the city of Turin initiated an extensive redevelopment program with the goal of revitalizing the area. The project, named Spina 3, aimed to create a new neighborhood that combines various functions, including residential, commercial, office, research, production, and recreational spaces. The redevelopment plan had access to substantial financial resources from both the Italian government and the European Union, with approximately 132 million euros allocated for the project.

The project faced the challenge of accommodating the needs of both old and new residents. The former industrial workers who had lived in the area for years, along with the newcomers, had high expectations for improved public services, including schools, transportation, sports facilities, post offices, and cultural centers. The transformation also involved the creation of the Dora Park, a central green space intended to be the “final touch” of the redevelopment.

The Spina 3 project aimed to address various aspects of urban life, from housing to employment opportunities and community spaces. The area was planned to host over 10,000 residents in more than 4,000 housing units by 2013. The redevelopment also involved significant architectural interventions, such as the construction of the Dora Commercial Park and the Santo Volto Church designed by Mario Botta.

Throughout its development, the Spina 3 project has sparked diverse opinions within the community. Some view it as an effective urban transformation that has brought new life to the area, while others have criticized its initial lack of public facilities and ecological criteria. A volunteer committee named Comitato Dora Spina Tre was founded in 2004 by local residents who believed in involving the community in the planning and realization of the project. This committee aimed to ensure that the needs and aspirations of the residents were considered in the transformation process.

In conclusion, the Spina 3 neighborhood in Turin is a significant urban transformation project that emerged from the closure of former industrial sites. The redevelopment aimed to create a diverse and vibrant neighborhood with various functions, accommodating both old and new residents. It highlights the challenges and opportunities of revitalizing post-industrial areas while prioritizing the well-being of the community and addressing their needs.

The selection of the Spina 3 district in Turin, Italy, for the preliminary design proposal of a self-sufficient neighborhood and the mixed-use building, is underpinned by several compelling reasons, all of which contribute to the feasibility and significance of this choice within the context of Italy and the Sustainable Development Goals (SDGs).
The Spina 3 redevelopment project is characterized by its inclusive approach to urban planning. It envisions a neighborhood that seamlessly integrates a wide spectrum of functions, including residential, commercial, office, research, production, and recreational spaces. This harmonious coexistence aligns with the principles of mixed-use architecture, a central tenet of self-sufficient neighborhoods, aiming to reduce the necessity for extensive commuting and foster self-reliance among residents.

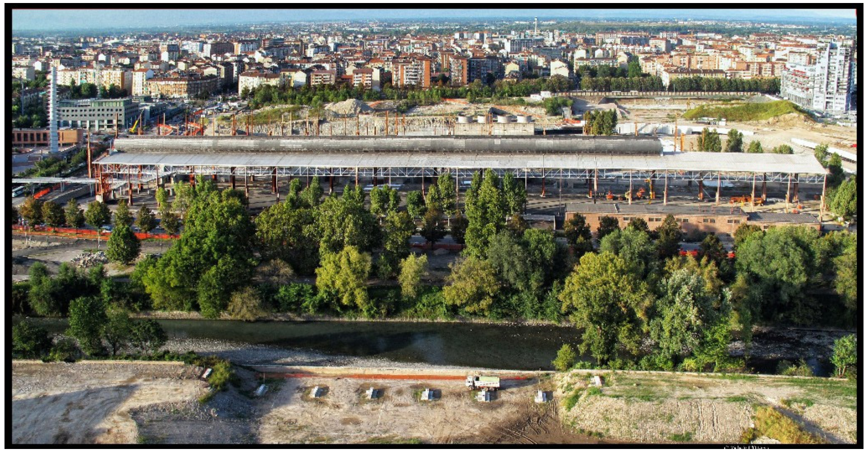
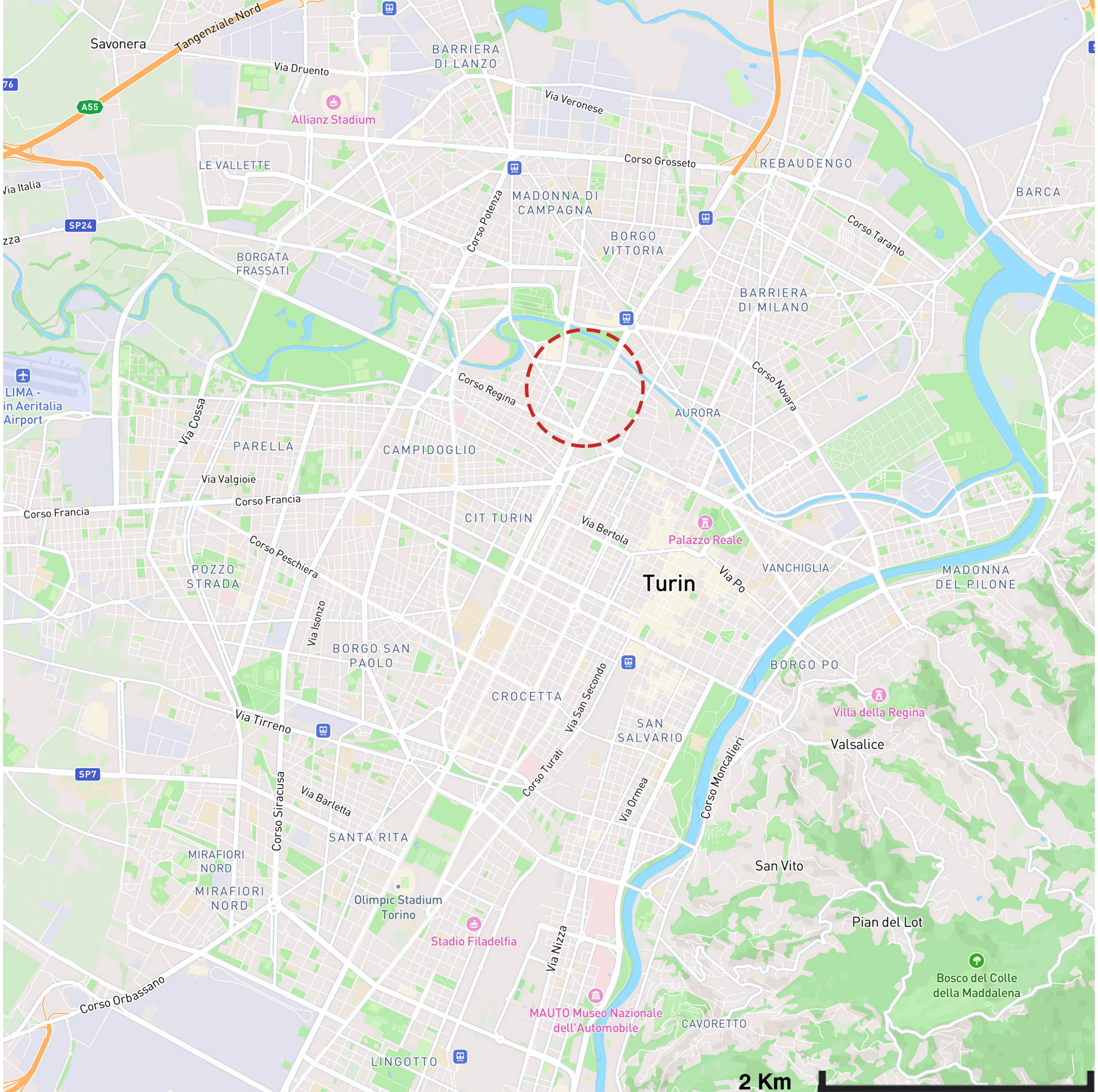


*Figure 24: I cantieri dell'area Spina 3 . Fotografia di Michele D'Ottavio, 2010. Reference: MuseoTorino.*

*Figure 25: I cantieri dell'area Spina 3 . Fotografia di Michele D'Ottavio, 2010.*
*Reference: MuseoTorino.*

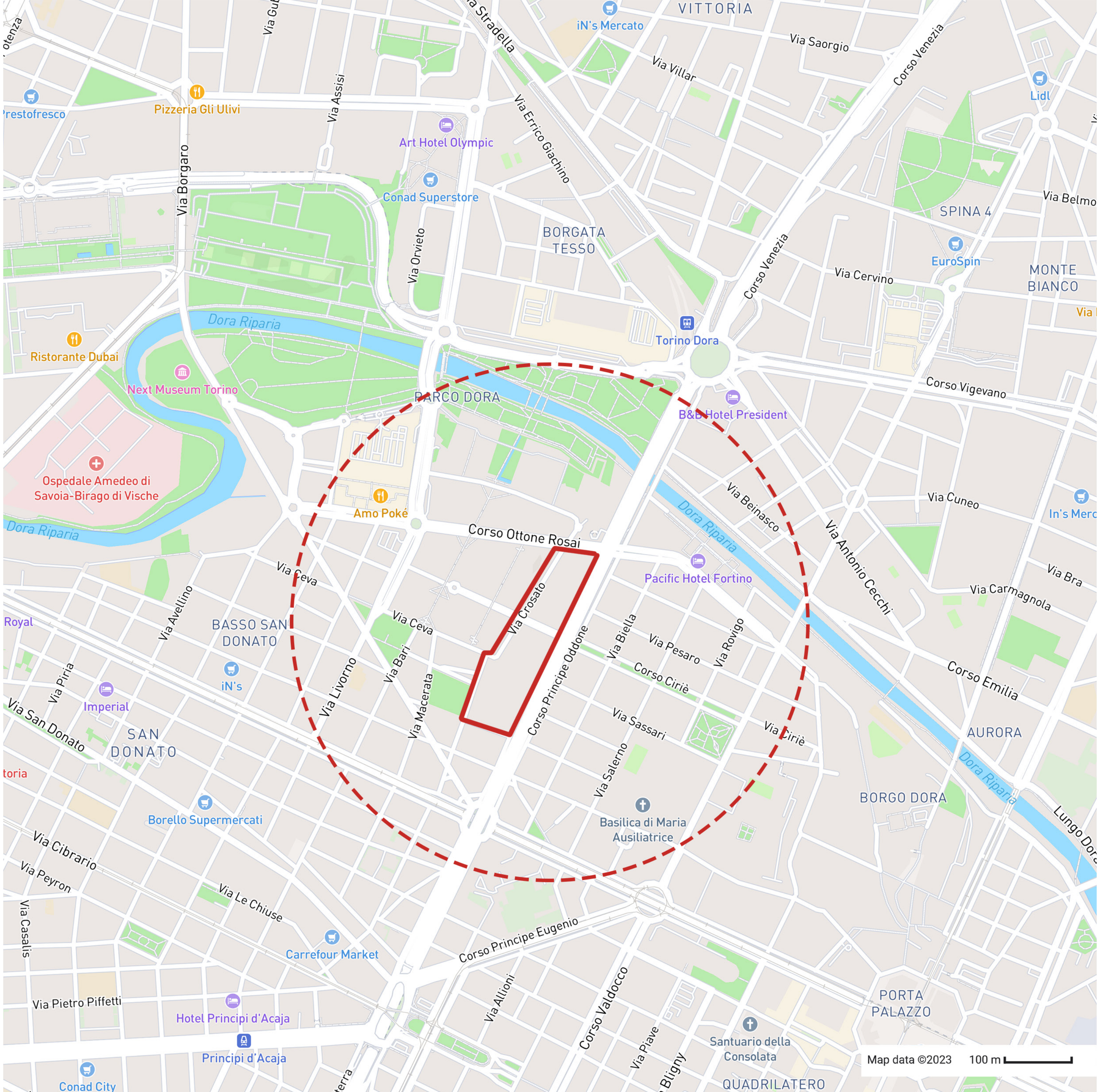
The European Union issued several directives in the field of energy efficiency which impact on the building sector in order to avoid a further increase of energy consumption and to mitigate climate change. The European Commission is shifting the focus away from the single level of the building towards the district scale in order to hit the target of post-carbon cities. Net Zero-Energy District (NZED) targets are emerging as a result. In order to evaluate alternative strategies for the construction of NZED, according to a socio-economic point of view, different aspects and impacts have to be considered. The proposed approach is developed from the Cost-Benefit Analysis (CBA) in order to include extra-economic benefits generated by the project. The proposed approach is applied on a real case concerning the energy requalification of a NZED in Turin (Italy).
The proposed approach is developed from the Cost-Benefit Analysis (CBA) in order to include extra-economic benefits generated by the project. The proposed approach is applied on a real case concerning the energy requalification of a NZED in Turin (Italy). The methodology provides a methodological basis for the definition, identification, quantification, and monetization of socio-economic impacts, and their insertion in a CBA framework. The proposed approach evaluates four alternative scenarios with respect to energy, environmental, and social criteria. The final step consists of the development of a sensitivity analysis in order to validate the results obtained. The proposed methodology provides a useful tool for decision makers in the field of sustainable urban energy planning.*(Becchio et al., 2018 p.1,11)*

## Location




Spina 3 neighborhood, situated in the northern part of Turin, embodies a fascinating juxtaposition of historical charm and modern urban vitality.

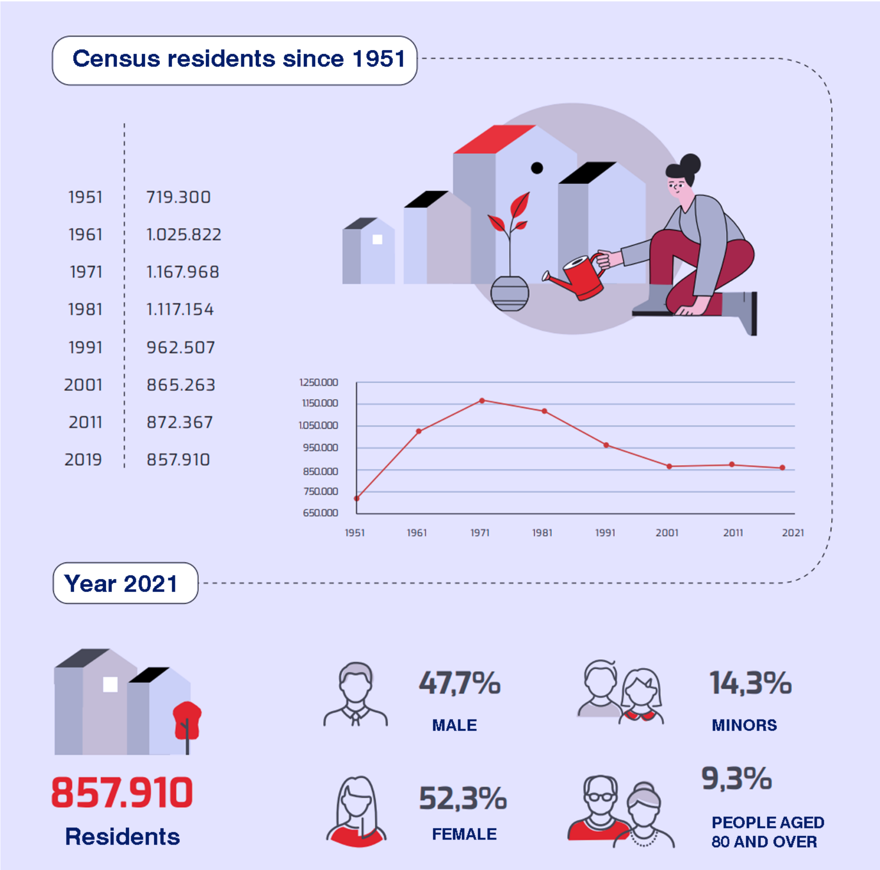
*Figure 26: Map of Turin city*
*Reference: Author ( with https://www.google.com/maps)*




The project site is situated at the crossroads of Corso Principe Oddone, Via Giovanni Battista Crosato, Via Savigliano, and Corso Ottone Rosai, this site enjoys a central and well-connected location in Turin. Its proximity to these major thoroughfares places it at the heart of urban life, making it accessible and easily accessible from various parts of the city. This strategic positioning not only offers convenience but also provides opportunities for vibrant interactions and activities within the bustling cityscape of Turin.

*Figure 27: Map of Turin city (Oddone neighborhood)*
*Reference: Author ( with https://www.google.com/maps)*

## Statistic data



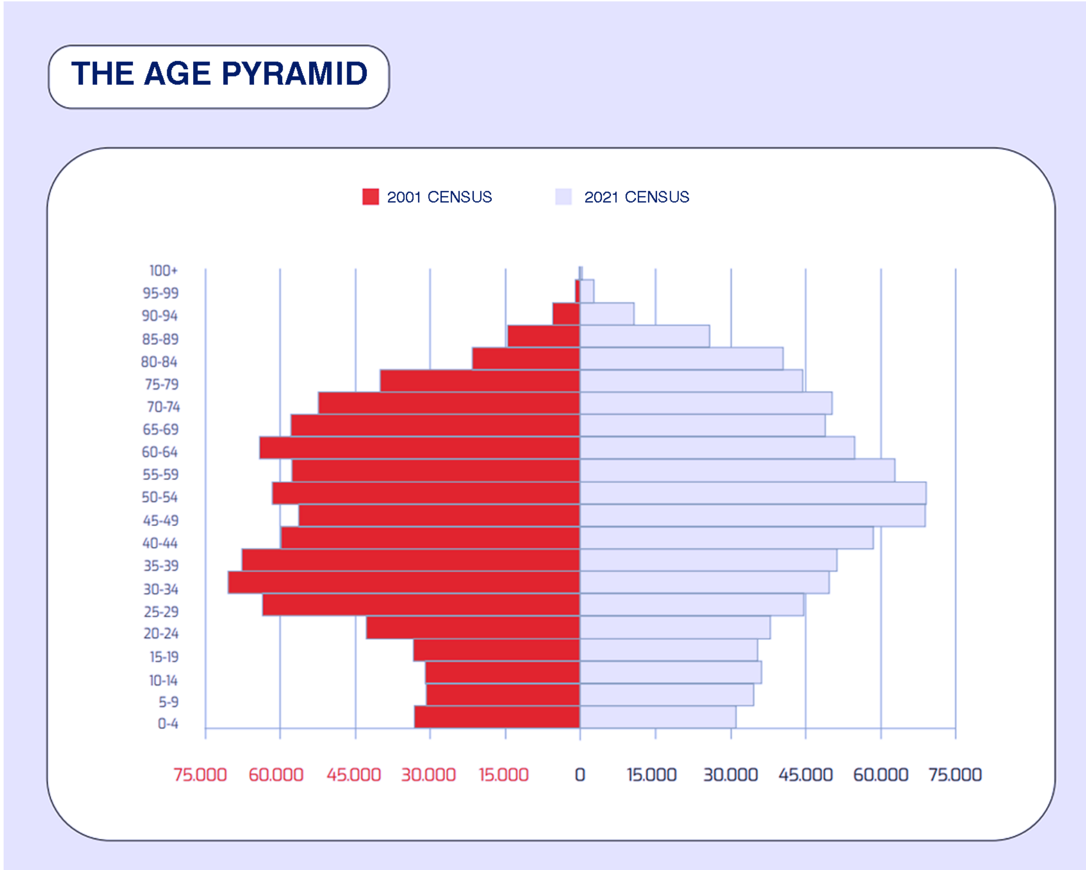




*Figure 28: Census residents since 1951*
*Reference: https://www.istat.it/it/files//2021/11/TORINO-infografica.pdf*

*Figure 29: The age pyramid*
*Reference: https://www.istat.it/it/files//2021/11/TORINO-infografica.pdf*

Turin, a major city in northern Italy, has a diverse and dynamic population. As of my last update, Turin had a population of approximately 858,000 people in 2021. This number might have changed since then due to natural population growth and migration trends.

Regarding the age pyramid, Turin, like many European cities, exhibits characteristics of an aging population. The age pyramid typically shows a narrower base (representing younger age groups) compared to the middle and upper sections (representing older age groups). This demographic pattern is influenced by factors such as declining birth rates and increased life expectancy.

The working-age population (between 15 and 64 years) remains a significant portion of Turin's demographic structure. This age group plays a crucial role in the city's economy and workforce. At the same time, there is also a growing elderly population (aged 65 and above), which is a common trend in many European cities.

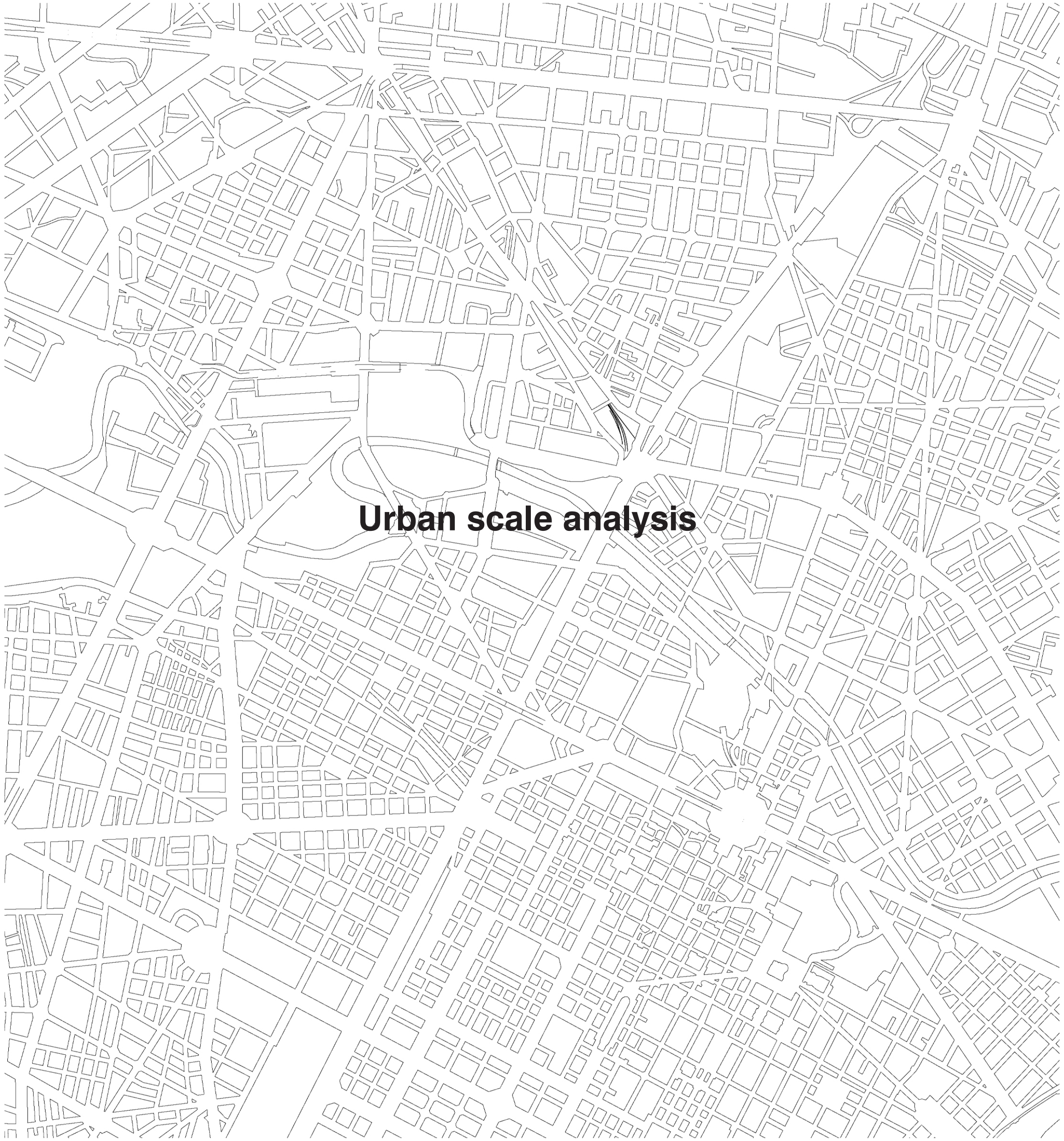



*Figure 30: Map of Turin*
*Source: Author*

The following pages summarize the urban framework in which the area that will be the subject of study is located:

First of all, it is important to underline how this area is currently free, and, therefore, its design completes the design of the surrounding urban lot.

The urban planning analysis considered the data provided by the initial urban Master plan ( Piano Regolatore Generale 1995) which provided specific measures for both the construction of buildings and public spaces. *(1)*

Today, the evolution of the demographic scenario (the population of Turin has decreased significantly since 1995 (over one million inhabitants) to today ( 848.748 inhabitants,2021 census ( ISTAT Italian Institute for Demographical Data, 2021)*(2)*), the evolution of the real estate market, the anthropic social system, are such as to be considered when a regeneration proposal is presented.
However, the proposal presented here takes into consideration both the average height of the buildings, in such a way as to provide for an intervention consistent with the surrounding "urban landscape", and the current demographic size (the neighbourhood still has a high population density) which of the already mentioned need for rapidly accessible services.
These considerations are the basis of the logic with which the project proposal was made.
The following pages are therefore subdividing the chapter into three parts: the first part is a graphic reading of the urban morphology (pages 78 -84), the second points up the main potential and problems of the site in question, the third compares the existing details sites with some designing preliminary ideas ( pages 91 to 98). This preliminary reading is the basis of the logic on which the design choices are based (Masterplan design strategies, pages 99 -102) which converge in the general Project Masterplan. (Page 103)

---

*(1)*

- In general to sum up on this area The estimate of the square meters of design for each intended use is as follows:
  Total Surface Area = 62.213 mq
- (a) Surface Area ( SLP) feasible for buildings in a project on your site = 49.647 mq
- (b) Surface Area ( SLP) feasible for buildings in the project transferred to d other sites in the city = 12.566 mq
- Surface area ( mq of site area ) for public services = 67.046 mq
- Maximum number of floors for buildings = 5 along Via Ceva
- Maximum number of floors for buildings sides of the lot = 7 along others

*Source: the City of Turin, Turin Urban Master Plan Institutional site of the City of Turin for Urban and Territorial Planning Geoportale http://geoportale.comune.torino.it/web/governo-del-territorio/piano-regolatore-generale*

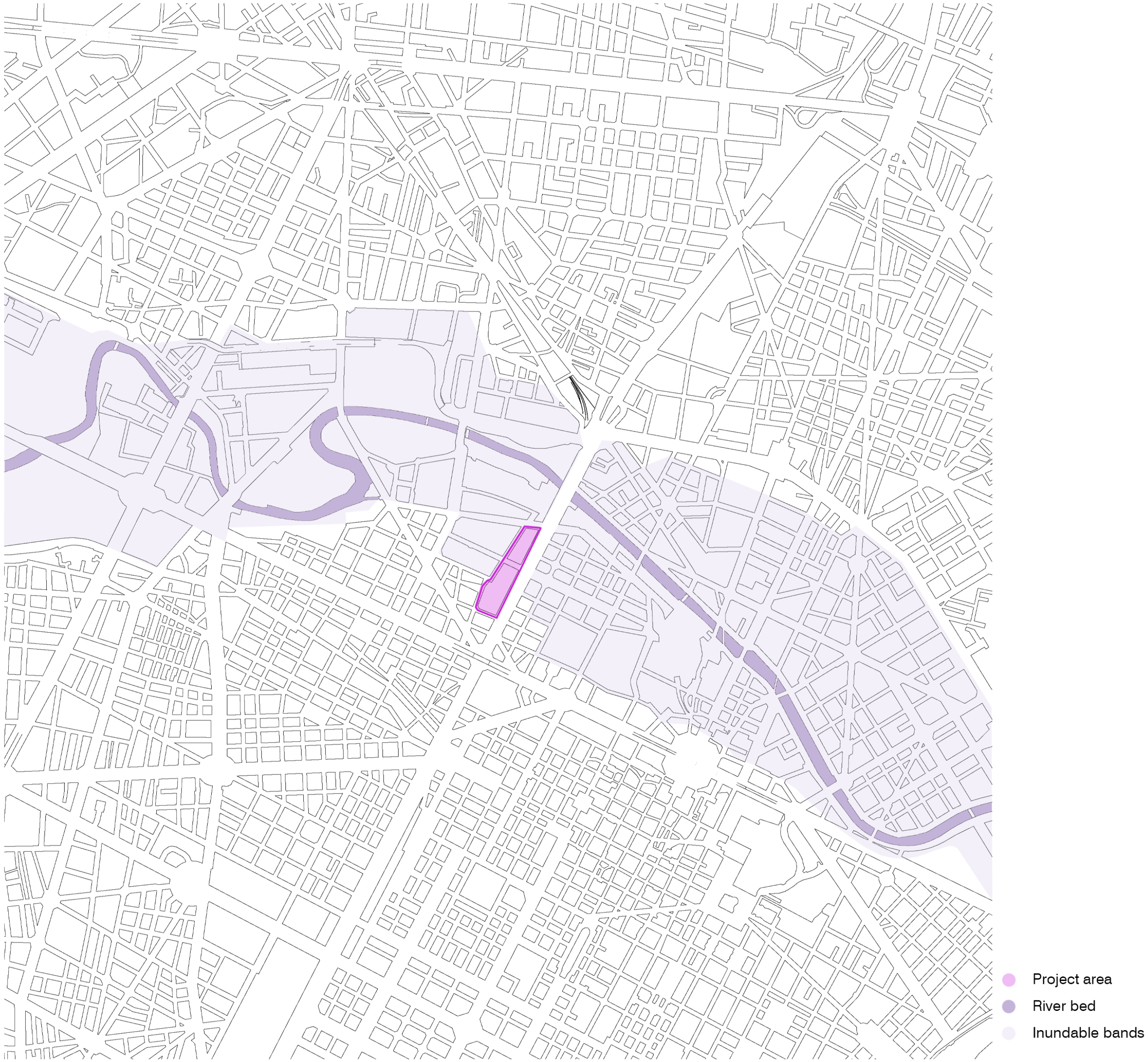
*(2)ISTAT demographical National official Agency: data's available on Institutional site documents https://www.istat.it/it/archivio/253517*

## Lying of the blocks


This map displays the arrangement of city blocks and urban structures within the area. It provides an overview of the urban planning and a high-density area.

*Figure 31: Map of Turin, Lying of the blocks*
*Source: Author*

## Hydrography and risk areas




This map focuses on the hydrography of the region, highlighting rivers and water bodies. Additionally, it identifies risk areas prone to flooding and the location of our design area is not so far from the river.

*Figure 32: Map of Turin, Hydrography and risk areas*
*Source: Author*

## Green urban areas


*Figure 33: Map of Turin, Green urban areas*
*Source: Author*

This map illustrates the green spaces within the urban environment, including parks, gardens, and recreational areas. It showcases the city's commitment to green infrastructure and offers insights into the distribution of natural refuges within the urban landscape.

## Sustainable and cycle mobility

This map provides an overview of the transportation infrastructure in the area. It highlights bike-sharing stations, cycle paths, car-sharing stations, and underground lines and the fact of the distance of our site to these infrastructures.

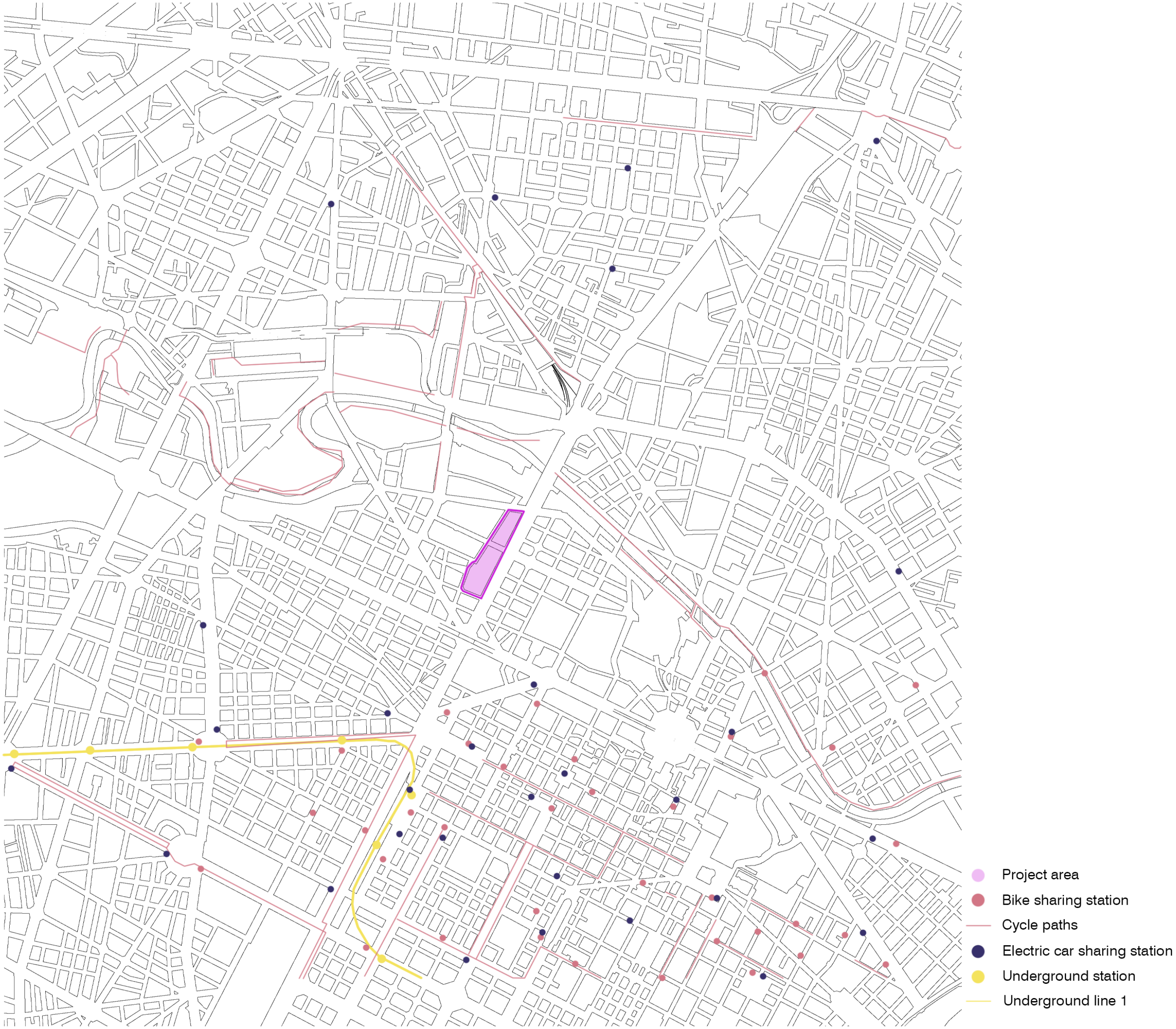



*Figure 34: Map of Turin, Sustainable and cycle mobility*
*Source: Author*

## Influential points of the area

This map identifies key points of interest in the area, such as parks, cultural centers, museums, and other significant landmarks.

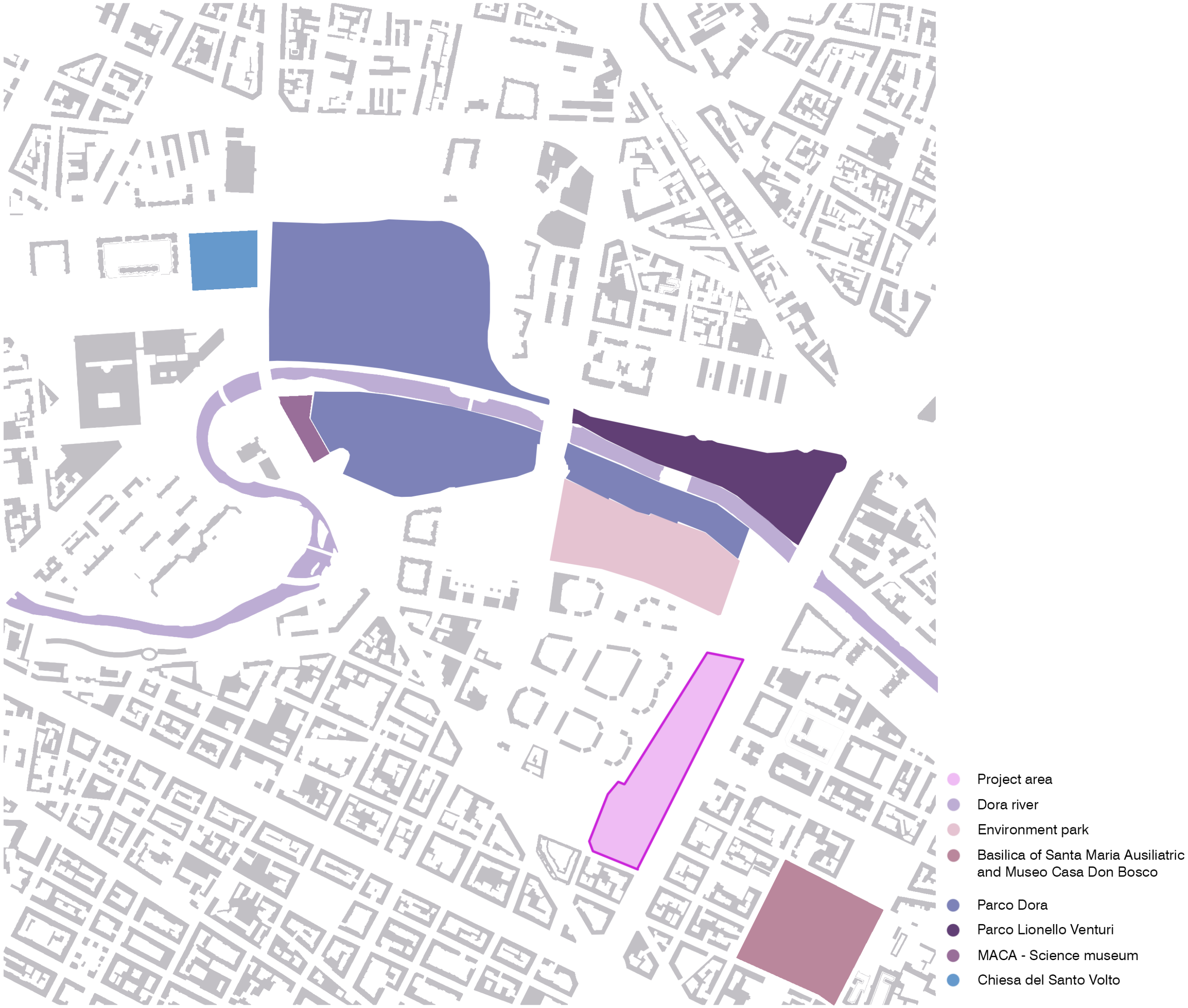



*Figure 35: Map of Turin, Influential points of the area*
*Source: Author*

# Mobility

This map displays a comprehensive view of the area's transportation infrastructure, highlighting highways, main urban access points, and general road networks.


*Figure 36: Map of Turin, Mobility*
*Source: Author*

## Site potentials and problems

Based on observation by the author

In this comprehensive urban analysis, we meticulously scrutinize the urban environment through on-site observations. By identifying and evaluating various aspects of the cityscape, we gain valuable insights into its dynamics and functionality. This investigation unveils a spectrum of findings, ranging from promising opportunities to existing challenges, all of which contribute to a holistic understanding of the urban context. These insights are instrumental in informing strategies for enhancing urban sustainability and livability.


*Figure 37: map of Turin city and site highlights*
*Source: Author*

Circle 1: The Church of the "Sacred Face" was designed and built (Architect Mario Botta 2004) and the surrounding transformation of the public space

Circle 2: Including Parco Dora, Environment Park, Dora River, and co-working offices

Circle 3: Including Italo Calvino Public Library and Pacific Hotel

Circle 4: The residential buildings that arose in the last 25 years in the context of the urban regeneration project.

Circle 5: Historic Basilica of Santa Maria Ausiliatrice (1868 designed by the architect Antonio Spezia)

# Site observation by the author

Using the open space of "Parco Dora" for various collective activities.Also possibility of designing temporary structure around the columns for different exhibitions or open markets.

Using huge existing sheds for co-working space for different companies and public.

Good mixture of residential and commercial in the neighborhood.

Figure 38: site observation
Source: Author


*Figure 39: map of Turin city*
*Source: Author*

# Site observation by the author


*Figure 40: site observation*
*Source: Author*


*Figure 41: map of Turin city*
*Source: Author*

# Site observation by the author

Existence of a cultural center in the middle of a residential part of the neighborhood, consisting of church, school, historical house,...

1. Appropriate riverside footpath and bike path
2. Existence of a Public library

Public gathering spaces between residential units but not with well designed urban furnitures.

*Figure 42: site observation*
*Source: Author*


*Figure 43: map of Turin city*
*Source: Author*

# Site observation by the author

Lack of proper access for pedestrians from the neighborhood to the parco Dora.

Lack of bike sharing space.

Lack of safe guards at the border of the street and the sidewalk.

*Figure 44: site observation*
*Source: Author*


*Figure 45: map of Turin city*
*Source: Author*


Circle 1: The Church of the “Sacred Face” was designed and built (Architect Mario Botta 2004) and the surrounding transformation of the public space

Circle 2: Including Parco Dora, Environment Park, Dora River, and co-working offices

Circle 3: Including Italo Calvino Public Library and Pacific Hotel

Circle 4: The residential buildings that arose in the last 25 years in the context of the urban regeneration project.

Circle 5: Historic Basilica of Santa Maria Ausiliatrice (1868 designed by the architect Antonio Spezia)

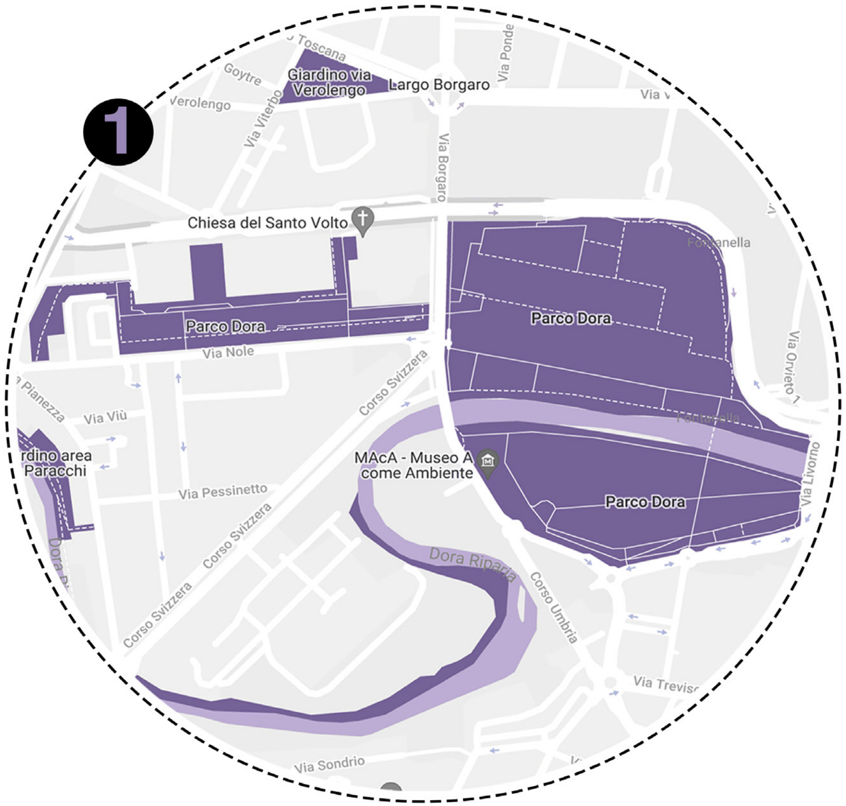
*Figure 46: map of Turin city and site highlights*
*Source: Author*

## Site Highlights

In the map on the left, we can see the most significant areas surrounding our studid area:

First of all, the urban spaces that distinguish the urban transformations of the last twenty years: the area in which the Church of the “Sacred Face” was designed and built (Architect Mario Botta 2004) and the surrounding transformation of the public space (circle 1), and the Historic Basilica of Santa Maria Ausiliatrice (1868 designed by the architect Antonio Spezia) (circle 5). Both these buildings and their surrounding areas constitute an important urban reference for the city and the area. The recent Church designed by the architect Botta is also a significant architectural reference concerning the urban transformations of Spina 3 that have taken place in the last 25 years.

Elements of urban planning potential are also the park and the important commercial and public space recently built as urbanization support services (Parco Dora Cerchio 1 shopping centre); the residential buildings that arose in the last 25 years in the context of the urban regeneration project (circle 4), the museum that commemorates the figure of Don Bosco, a very important historical figure, especially for this neighbourhood which was the neighbourhood in which he worked.




### EXIST

1. Dora Park
2. Skateboard park
3. Dog park
4. Playground
5. Existing columns
6. Santo Volto church
7. Park
8. Science museum

### DESIGN IDEA

1. Starting point of the Green corridor
2. Open market
3. Temporary Exhibition to works with the church and museum
4. Leisure hub

*Figure 47: map of Turin city and site highlights*
*Source: Author*



## EXIST

1. Park
2. Dora River
3. S - Svago shopping mall
4. Zero-Gravity Torino Amusement park
5. Co-working offices
6. Environment Park

## DESIGN IDEA

1. Redesigning facades of co-working buildings
2. Urban plaza
3. Urban furniture
4. Pedestrian bridge to connect different points of the neighborhood

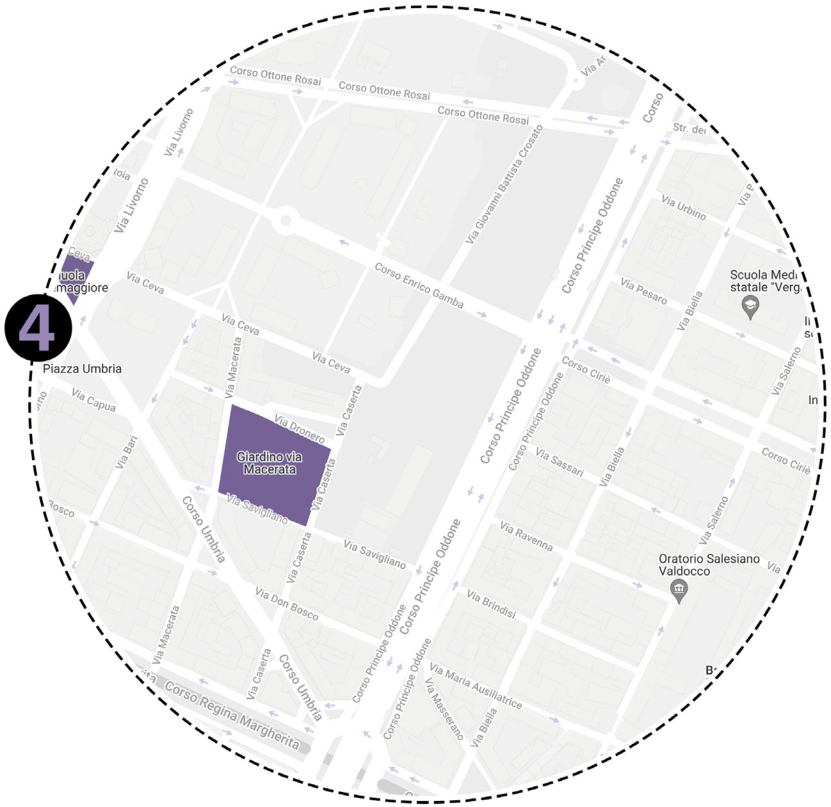
## EXIST

1. Public library
2. Piazzetta(small square)
3. Hotel

## DESIGN IDEA

1. Redesigning Urban furnitures in piazzetta

*Figure 48: map of Turin city and site highlights*
*Source: Author*




## EXIST

1. Spina 3 residential buildings
2. Empty design area

## DESIGN IDEA

1. Vertical farming design due to the soil pollution
2. multi functional building design


## EXIST

1. Casa Don Bosco museum
2. Basilica Santa Maria Ausili-atrice
3. School
4. Performing arts theater
5. Youth centre

## DESIGN IDEA

1. Organize this place as a neighborhood center

*Figure 49: map of Turin city and site highlights*
*Source: Author*


## Design Ideas
### 01. pedestrian Urban bridge

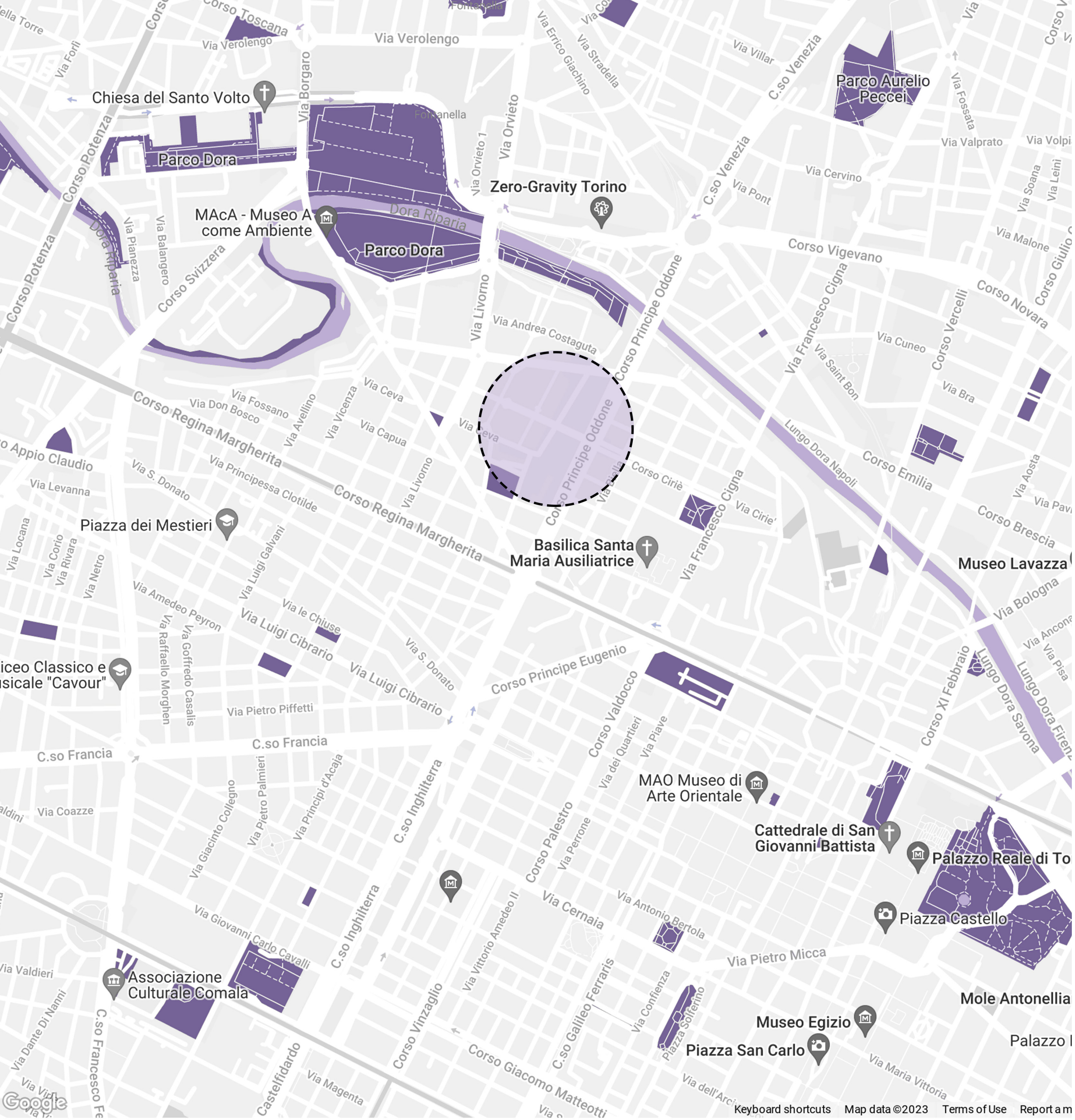
1. In different levels and making shadow
2. Creative space for plaza
3. For pedestrian ( and bike)
4. Make connection between residential and commercial parts of the neighborhood

*Figure 50: map of Turin city and site highlights for design ideas*
*Source: Author*


## Design Ideas
### 02. Green corridor

1. Expanding the green space of parco Dora around the neighborhood
2. Make a connection between critical points ( museum, Environmental park, school, plaza, cultural centre,...)
3. Improving the pedestrian and bike path

*Figure 51: map of Turin city and site highlights for design ideas*
*Source: Author*




## Design Ideas
### 03. Vertical Farming

Vertical farm design can be an appropriate choice due to the soil pollution of the area and can cover the food demand of neighbor-hood based on " self sufficiency" criterias.

*Figure 52: map of Turin city and site highlights for design ideas*
*Source: Author*

## The Logic of the Masterplan Project

The preliminary logic of the design of the buildings and related spaces considers very carefully how we have already seen the relationships with the surrounding urban space.
The definition of the dimensions and heights of the buildings was designed in correlation both with what was initially established by the urban plan and with the dimensions of the surrounding buildings; both the buildings built along the axis of Parco Dora with the urban transformation of the last twenty-five years and the existing buildings.
The size of the designed building fits into this context.
The architectural choice also considers the relationships with the neighborhood and the absence of architectural references or buildings of particular historical importance. This means that there are no monumental constraints. This therefore allows the design of a building that can also become an architectural element of reference for the area

Similar reasoning is made for the design of public space and support services for the building and the neighborhood. These, in addition to achieving the objective of “self-sufficiency”, also want to define a meeting space and a reference for the community. This is why they are located between the two buildings and are easy to access from the mobility system.

Specialized aspects preliminary to the design also concern the definition of “Green corridors”, “Open spaces”, “water conservation”, sustainable transportation “waste management” and “Mixed buildings” which we can detail below.

## Masterplan Design strategies

1. Green Corridors and Open Spaces:
Identify existing green spaces and potential areas for creating green corridors connecting them.
Design pedestrian and bike-friendly paths along these corridors to encourage active mobility and enhance connectivity.

2. Water Conservation and Management:

Implement rainwater harvesting systems in public buildings and open spaces to collect and reuse rainwater.
Integrate green infrastructure elements like bioswales and permeable pavements to manage stormwater runoff.
_water consumption
_water management
_natural water system
_flood risk areas
_flooding prevention strategies
_soil permeability
_rainwater harvesting

3. Sustainable Transportation:

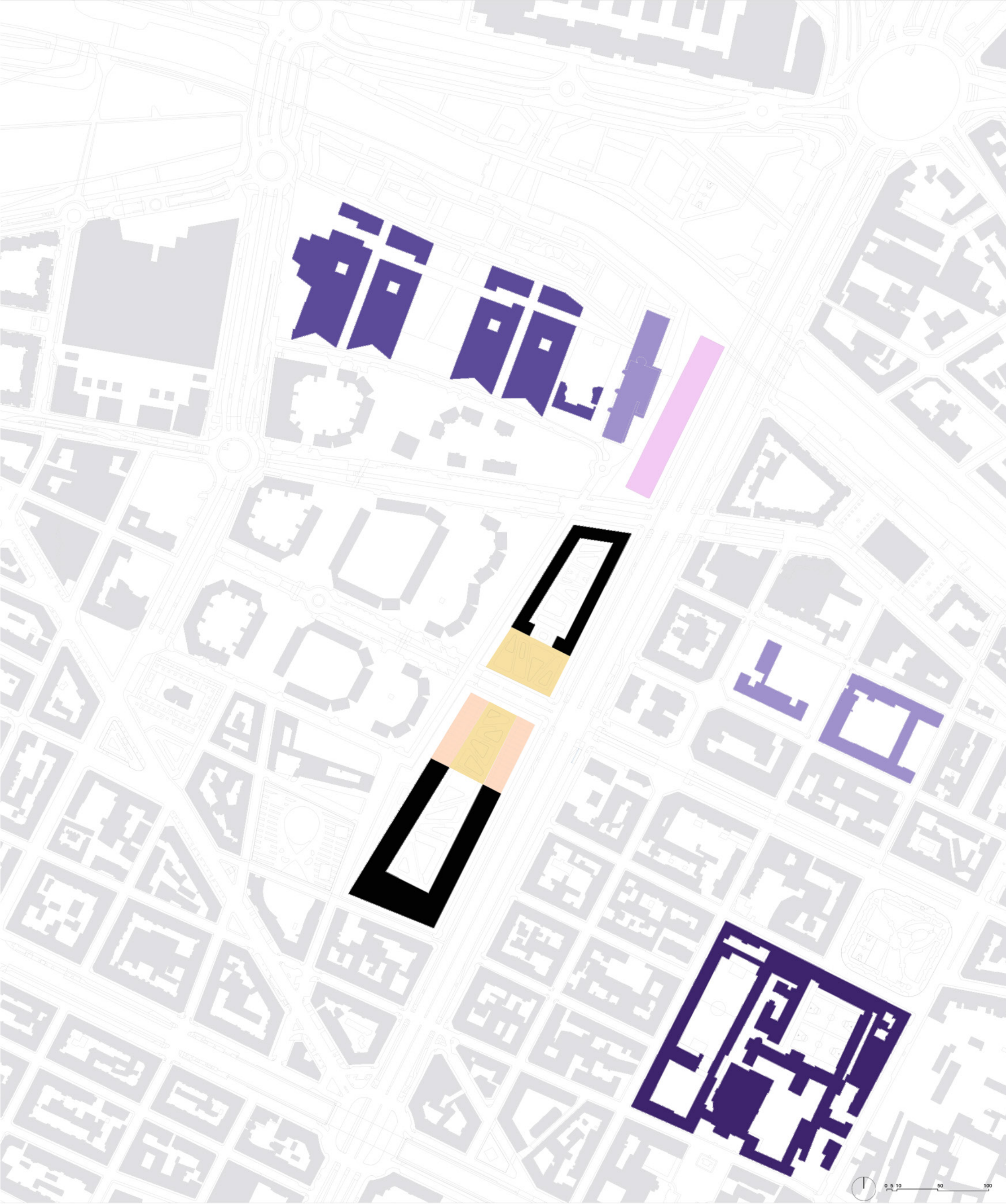
Design a comprehensive transportation network that includes dedicated bike lanes, pedestrian pathways, and efficient public transit options.
Prioritize transit-oriented development near public transportation hubs to reduce reliance on private cars.

4. Waste Management and Recycling:

Implement a neighborhood-wide waste separation and recycling program.
Integrate recycling stations and composting facilities in public areas and mixed-use buildings.

5. Mixed-Use Buildings:

Design mixed-use buildings with a variety of functions and flexible spaces to accommodate diverse activities and services.
Incorporate shared facilities and common spaces to foster social interactions among residents.



**Social Infrastructures**

- Social Attractors
- Educational Hub
- Proposed Vertical Farm
- Innovation Hub
- Designed plaza
- Designed Open Market

This map illustrates the strategic placement of key social infrastructures within the project site. It highlights the locations of social attractors, which serve as community gathering points, as well as the innovation and education hubs. Additionally, it showcases proposed design infrastructures aimed at enhancing social interactions and community well-being.

*Figure 53: Site plan - social infrastructures*
*Source: Author*

This map provides a comprehensive view of the green infrastructures integrated into the site plan. It maps out the distribution of green spaces, including parks and recreational areas, within the project site. It also details the site flooring design, emphasizing eco-friendly and sustainable flooring materials chosen to promote environmental consciousness and sustainability.

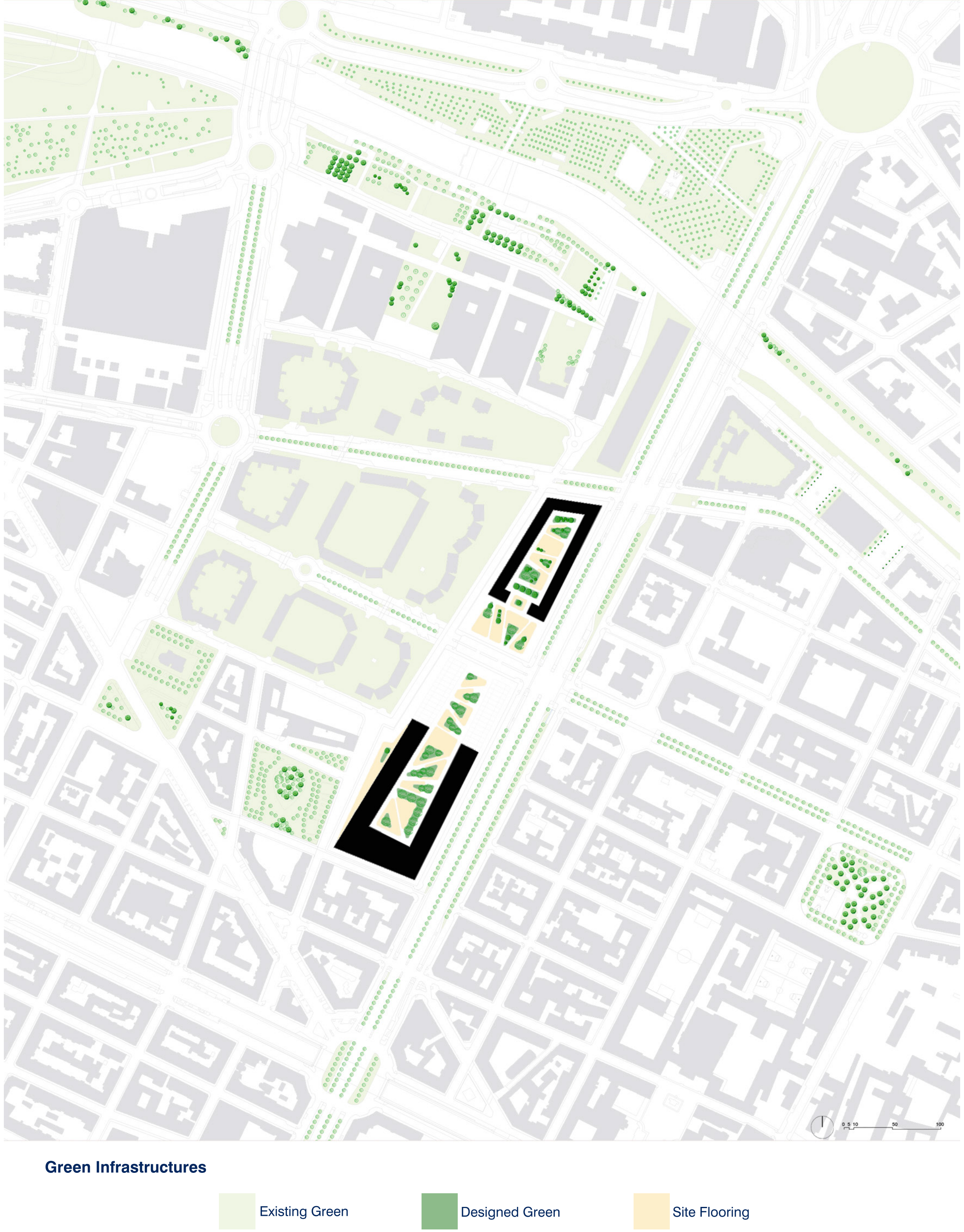
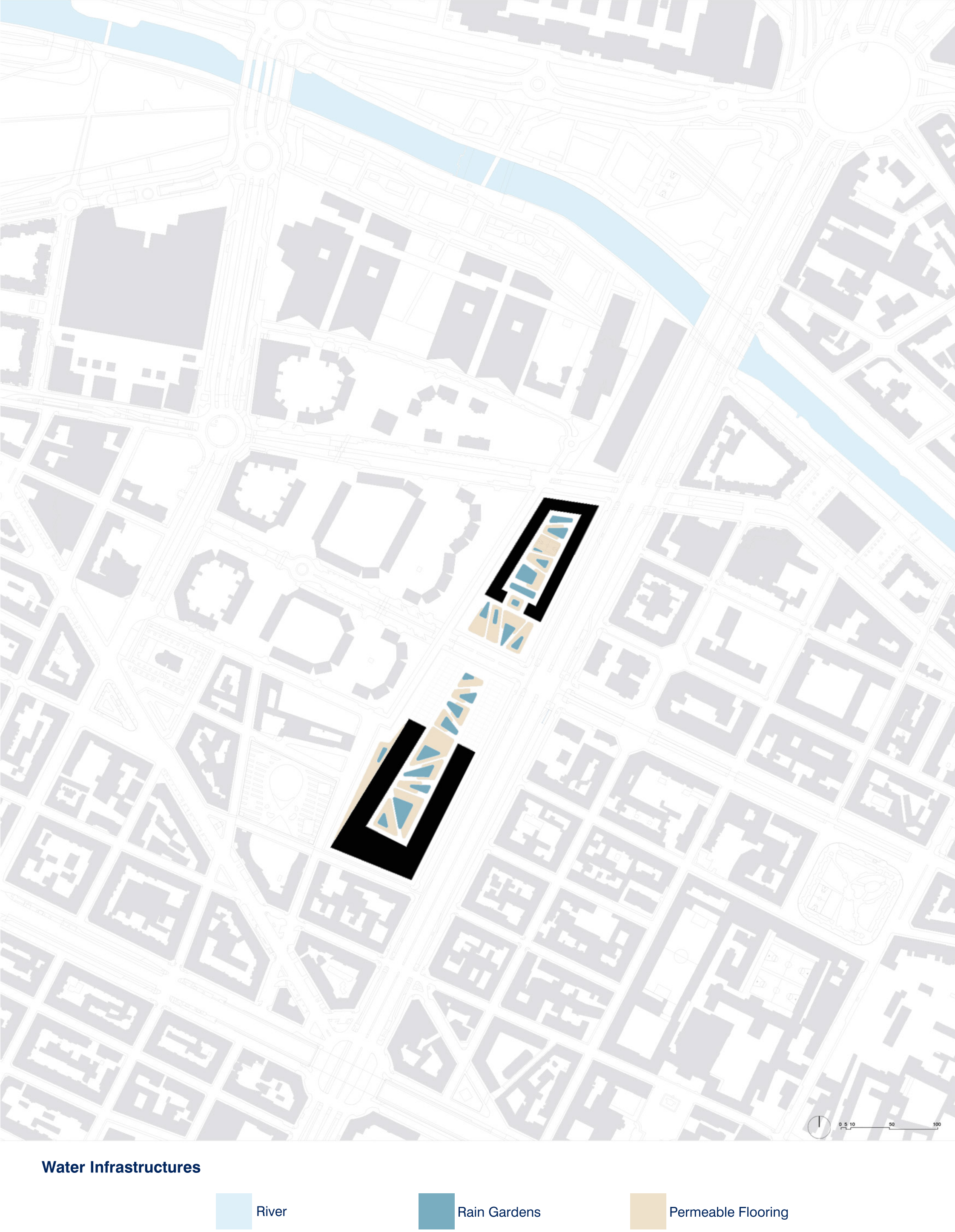
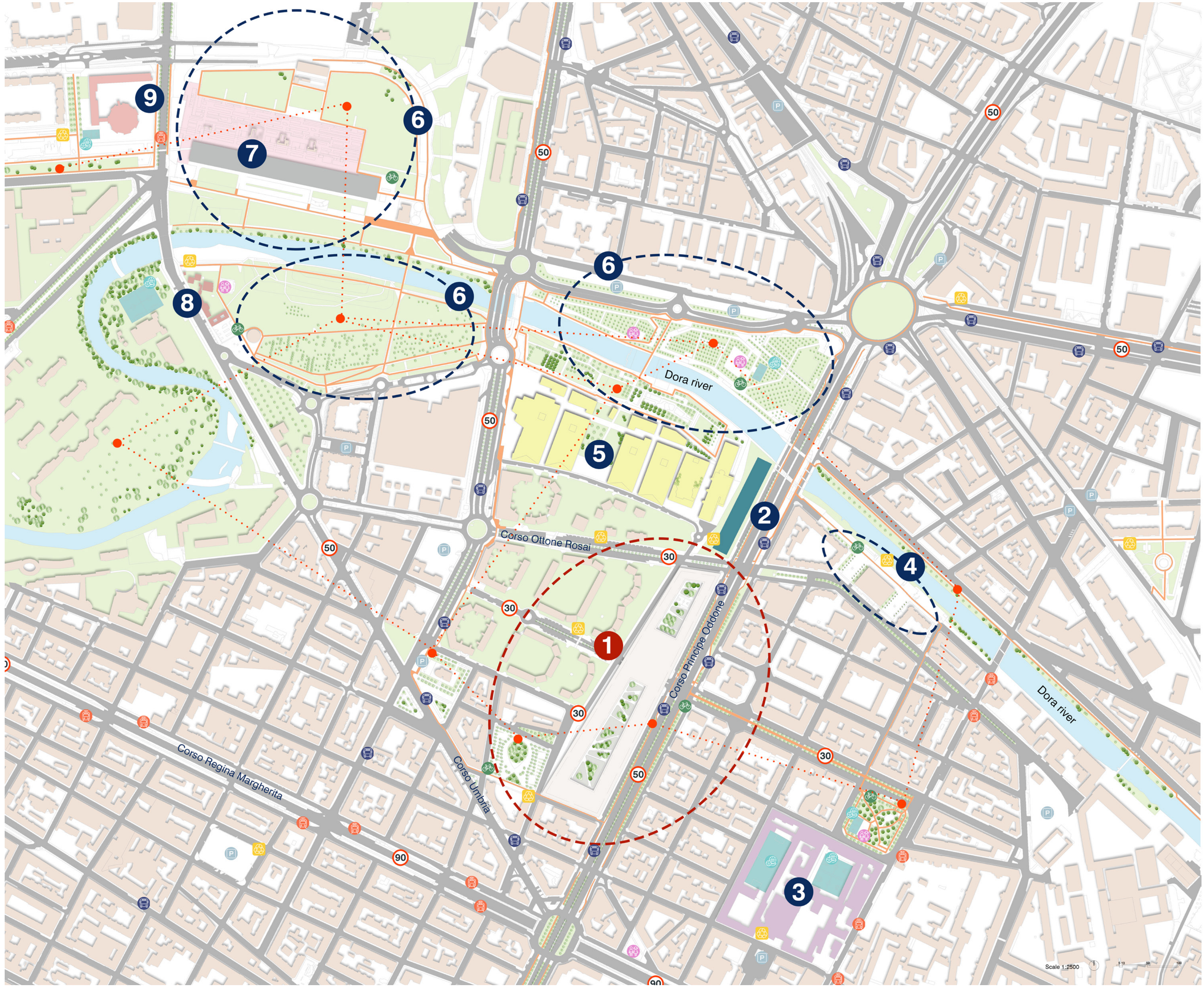



*Figure 54: Site plan - Green infrastructures*
*Source: Author*




This map focuses on the water infrastructure elements incorporated into the project site. It highlights the presence of the river, emphasizing its significance in the overall site plan. Additionally, it showcases the location of rain gardens designed for water conservation and management. The map also indicates areas with permeable floorings, demonstrating a commitment to sustainable water practices and minimizing environmental impact.

*Figure 55: Site plan - Water infrastructures*
*Source: Author*




## Master Plan

### Design Proposal

1 Mixed-use Building
2 Vertical Farming

Green Cycle
Waste Tube

### Functions

3 Cultural Center
4 Urban Plaza
5 Environment Park
6 Parco Dora
7 Skatepark Parco Dora
8 Science Museum
9 Archdiocese of Turin

Sport Field
Children Playground

Residential
Green Area
Dora River

### Mobility

Parking Area
Bike-sharing station
Tram Station
Bus Station

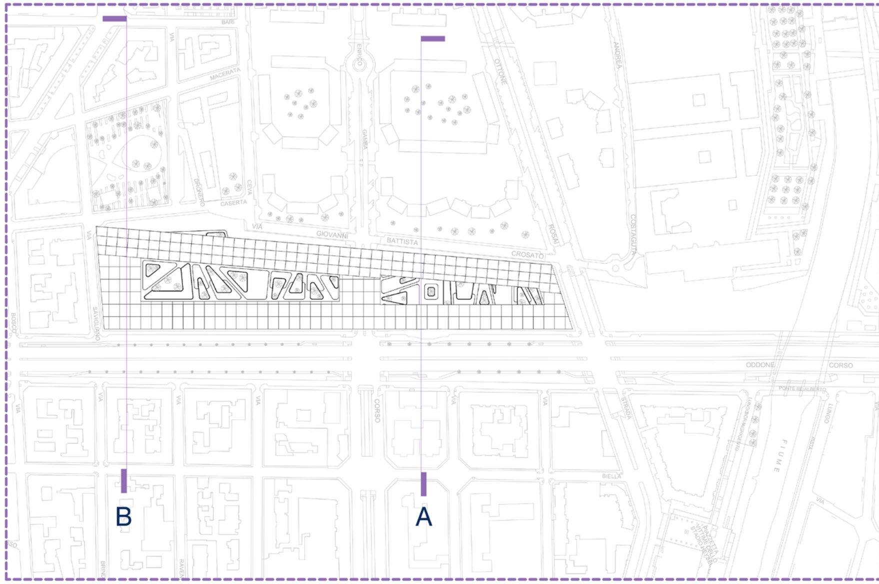
30 Km/h Speed Limit
50 Km/h Speed Limit
90 Km/h Speed Limit

Driving Surface
Bike Lane

N. 01

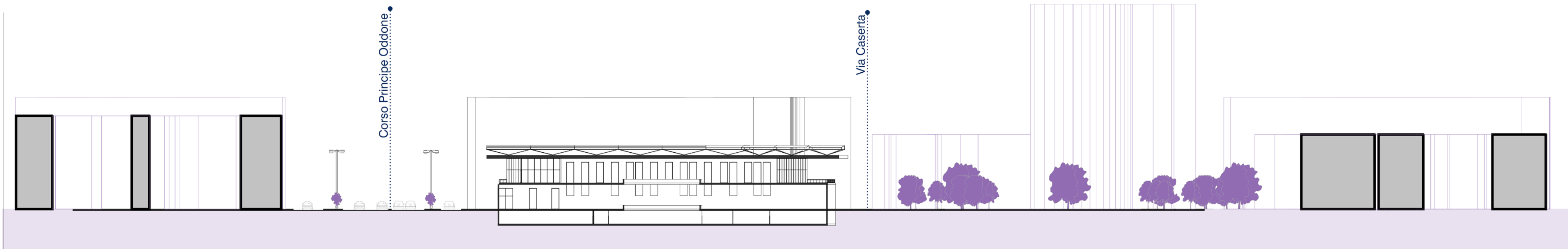
*Annex A.1: Master plan design proposal*
*Source: Author*

## Urban Sections





Urban Section A-A




Urban Section B-B

*Annex A.2: Urban Sections*
*Source: Author*

## It is all in the tube

The new era of residential living calls for novel recycling solutions. At Kalasatama, an inventive pipeline-based waste collection system has been introduced, infusing cutting-edge technology into waste management on an unprecedented scale. The waste travels underground through a network of pipes to the waste collection station with remarkable speed. Trucks then transport the waste, utilizing it either as recycled material, converting it into biogas, or using it for energy through incineration. The system greatly enhances the comfort of daily living for residents. Traditional waste bins vanish from the landscape, considerably reducing truck traffic near the residences. The system is user-friendly, secure, and operates quietly.

However, how does this system operate? Waste collection points are conveniently located at exits in each building block. Residents are responsible for segregating waste - including mixed waste, biowaste, paper, cardboard, and plastic packaging - and delivering them to designated waste collection points. The system operates autonomously, automatically emptying waste collection points. With speeds of up to 70 km/h, waste is rapidly transported to the waste collection station, where it is directed into designated waste containers. Trucks collect the full containers from the station, transporting waste for further processing. Proper waste sorting is essential - there are five distinct waste points, so make sure to avoid confusion. With common sense as your guide, you'll quickly become a recycling pro! *(Reference: Kalasataman IMU. (2023). )*


*Figure 56: IMU pipes for waste management*
*Reference: Kalasataman IMU. (2023).*

# WE CAN SORT IT OUT!

Sorting out the waste - the right way - is the key. There are five separate waste point - don`t get them mixed up! Don`t worry, common sense is really the only tool needed here. Here`s your quick guide to a greener tomorrow - pretty soon you`ll be a recycling champion!

## BIOWASTE

Leftovers from meat, fish, fruit, bread and vegetables; eggshells, coffee grounds, filter bags, kitchen paper and cut flowers

**REMEMBER!**
Use a bag designated for biowaste; be sure to close the bag carefully

## PAPER

Newspapers, magazines, advertisements, brochures, catalogues, copy and drawing paper, soft-cover books, paper bags and envelopes made of white paper

**REMEMBER!**
Avoid blocking the tube - throw papers loose or in small unbound bundles. Do not place them in brown paper bags or plastic bags

## CARDBOARD

Milk and juice cartons, cereal and cookie packages, sugar and flour bags, pastry boxes, egg cartons, cardboard packages of beverages, paper roll cores, plastic surface wrapping paper, paper bags

**REMEMBER!**
Rinse liquid containers after use, flatten and place inside an empty container. Tear up pizza boxes before placing them in the tube

## MIXED WASTE

Plastic bags, diapers, dirty packages, small plastic items

**REMEMBER!**
A regular plastic bag is well suited for the task – but leave one third (1/3) of the bag empty and close it carefully

## PLASTIC PACKAGING

Empty, clean and dry plastic food packaging, detergent, shampoo and soap packaging, plastic bottles, cans and jars, plastic carrier bags, bags and wrappings. Caps, covers and pump parts separately.

**REMEMBER!**
Pack plastic packaging into a plastic bag before placing it in the tube.

*Figure 57: IMU pipes for waste management for different wastes*
*Reference: Kalasataman IMU. (2023).*


HEALTH FIRST

Chapter Five

# Block Scale Design

*Illustrations: Ana María Ospina*

This chapter addresses the central issue of the project, namely the design of a mixed-use building as the block designs
The priority lies both in the preliminary considerations of the master plan with which the previous chapter ended and in the implementation on a project scale of the theories and objectives necessary to create a self-sufficient block.
In this context, some priority detailed elements of the project can be defined below:

## Block Design strategies

1. Zoning and Space Allocation: Plan the building layout to allocate specific zones for different functions, ensuring efficient use of space. Designate separate areas for the children zone, library, open market, shops, and classrooms to create distinct yet interconnected spaces.

2. Vertical Mixed-Use Design: Optimize space by incorporating multiple functions vertically within the building. For example, dedicate lower floors to commercial spaces like shops and restaurants, and reserve upper floors for residential units.

3. Energy Efficiency and Renewable Energy Generation: Utilize energy-efficient building materials, windows, and insulation. Incorporate energy-efficient lighting and appliances in commercial and residential units to reduce overall energy consumption. Install solar panels or other renewable energy systems on the building's roof to generate clean electricity to power common areas and reduce reliance on the grid.

4. Water Conservation: Implement water-saving fixtures and fittings, such as low-flow toilets and faucets, in both commercial and residential spaces. Consider using greywater recycling systems for non-potable water uses.

5. Waste Management: Design waste separation and recycling facilities within the building to encourage proper waste disposal and recycling practices among residents and businesses.

6. Shared Spaces and Amenities: Create shared spaces, such as a central courtyard or rooftop garden, that serve as gathering areas for residents, visitors, and users of the building's functions. These spaces can also host community events and activities.

7. Interactive Art and Educational Installations: Integrate interactive art and educational installations within the building's public areas to engage visitors, encourage learning, and add aesthetic value to the space.

8. Market and Shops: Reserve the ground floor or a designated section for the open market and shops. Create a welcoming and pedestrian-friendly retail space that connects with the neighborhood's streetscape, encouraging foot traffic and local business growth.

9. Privacy Considerations and Separate Entrances: Plan the layout and arrangement of residential units to minimize overlooking and provide residents with a sense of privacy and consider providing separate entrances for residential units to further enhance privacy and distinguish residential and commercial activities.

10. Co-working Space and Flexible Workstations: Integrate a co-working space within the building to cater to the needs of remote workers, freelancers, and entrepreneurs in the neighborhood.

The following pages display various options that were considered for the building's shape, the attention given to 'Mixed-Use Design' principles, the evolution of the design process (which underwent revisions and debates during systematic work), and the final choice. As evident in the axonometric section on pages 107 and 108, the final choice involved a linear roof. This decision resulted from a reflective process considering the need to ensure the functionality of the building and the envisaged public spaces, aligning with the concept of a self-sufficient community.
The project drawings attached to the thesis provide additional support for these considerations.


The project site is situated at the crossroads of Corso Principe Oddone, Via Giovanni Battista Crosato, Via Savigliano, and Corso Ottone Rosai, this site enjoys a central and well-connected location in Turin.

*Figure 58: Block scale Design Map*
*Source: Author*

## Mixed-use building design ideas and alternatives

1. Maintain accessibility of the street between two parts of the site.
2. Use a horizontal design to avoid obstructing the view of surrounding buildings.
3. Allow for access from the street to the green rooftop to create a gathering space.
4. Respect the skyline and surrounding architecture.
5. Create an aesthetically pleasing and visually interesting design.

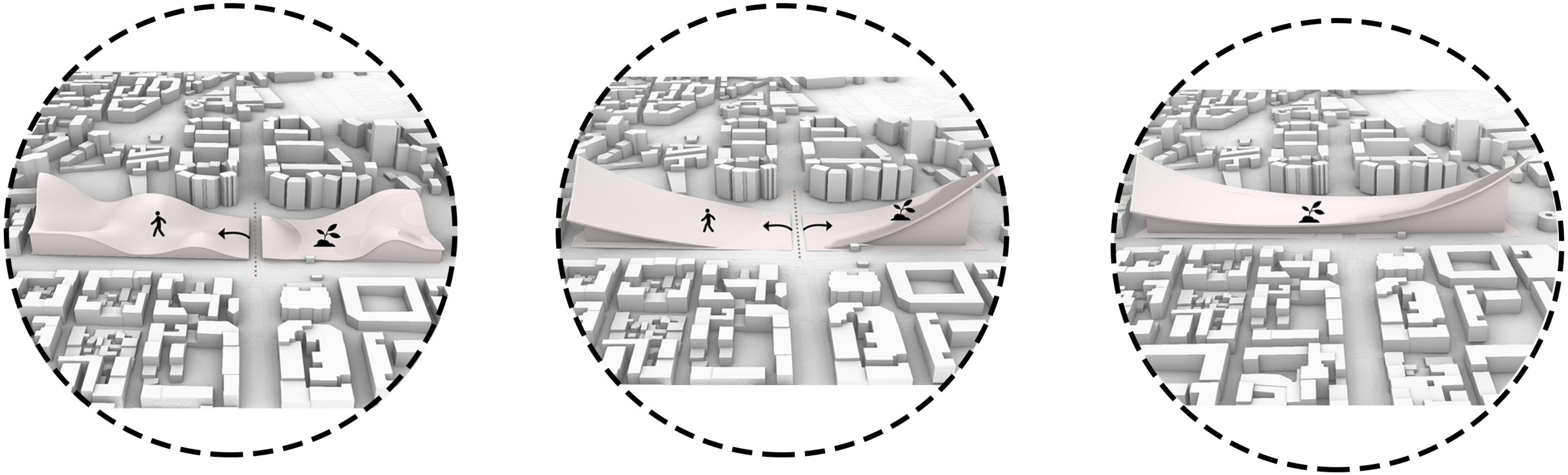
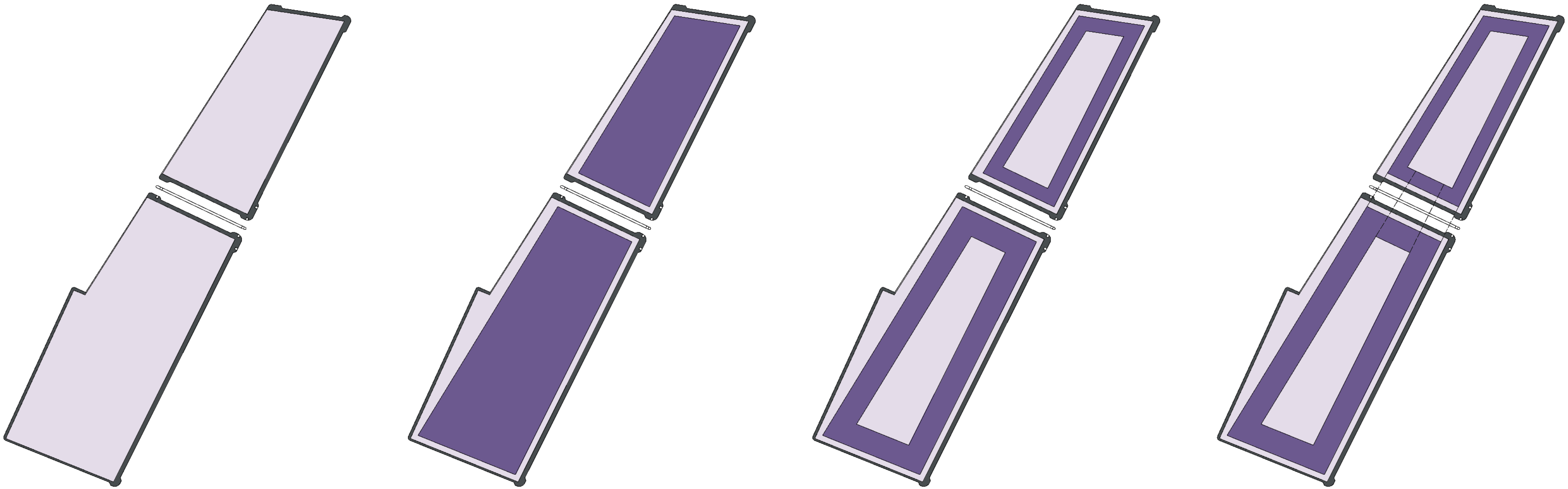


*Figure 59: Mixed-use building design ideas and alternatives*
*Source: Author*

*Figure 60: Mixed-use building design ideas and alternatives*
*Source: Author*



**STEP 1**

The site  consist of 2 distinct plots facing each other which are separated with passing a street.

**STEP 2**

Offsetting with the amount of min 5 meters from the edges.

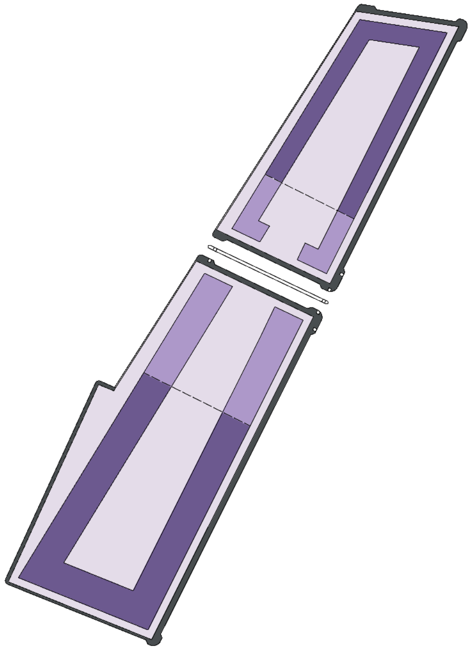
**STEP 3**

Introducing courtyards bring day light and natural ventilation in to the building. with the depth of 20 meters for public part including Exhibition and offices and 12 meters for semi private and private parts, including social housing and private residential units allowing for flexible layouts.

**STEP 4**

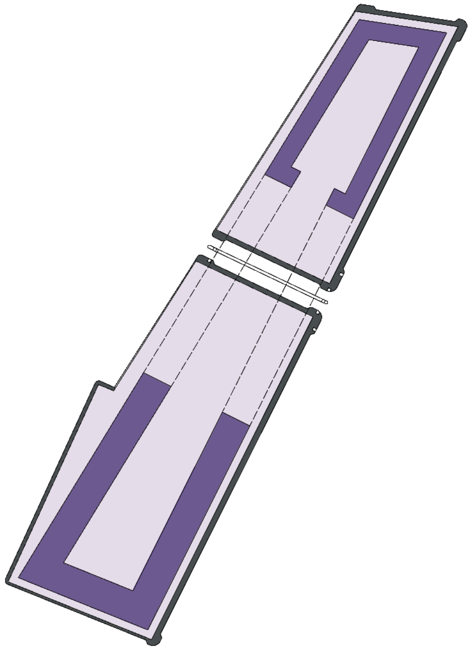
Considering an offset from the street to create a plaza in the middle for public open space.

*Figure 61: Design process diagram*
*Source: Author*



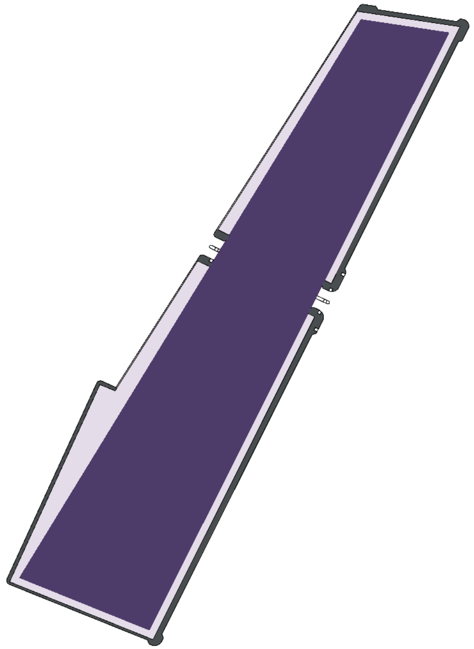
**STEP 5**

Introducing courtyards bring day light and natural ventilation in to the building. with the depth of 20 meters for public part including Exhibition and offices and 12 meters for semi private and private parts, including social housing and private residential units allowing for flexible layouts.



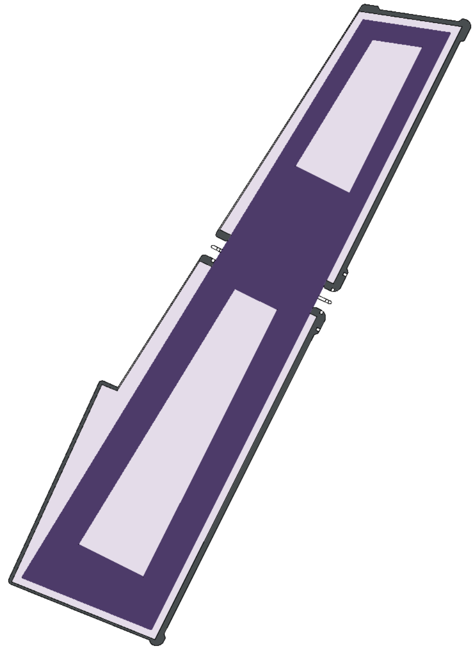
**STEP 6**

Making the residential part more private by adding two parts in the entrance of its courtyard.



**STEP 7**

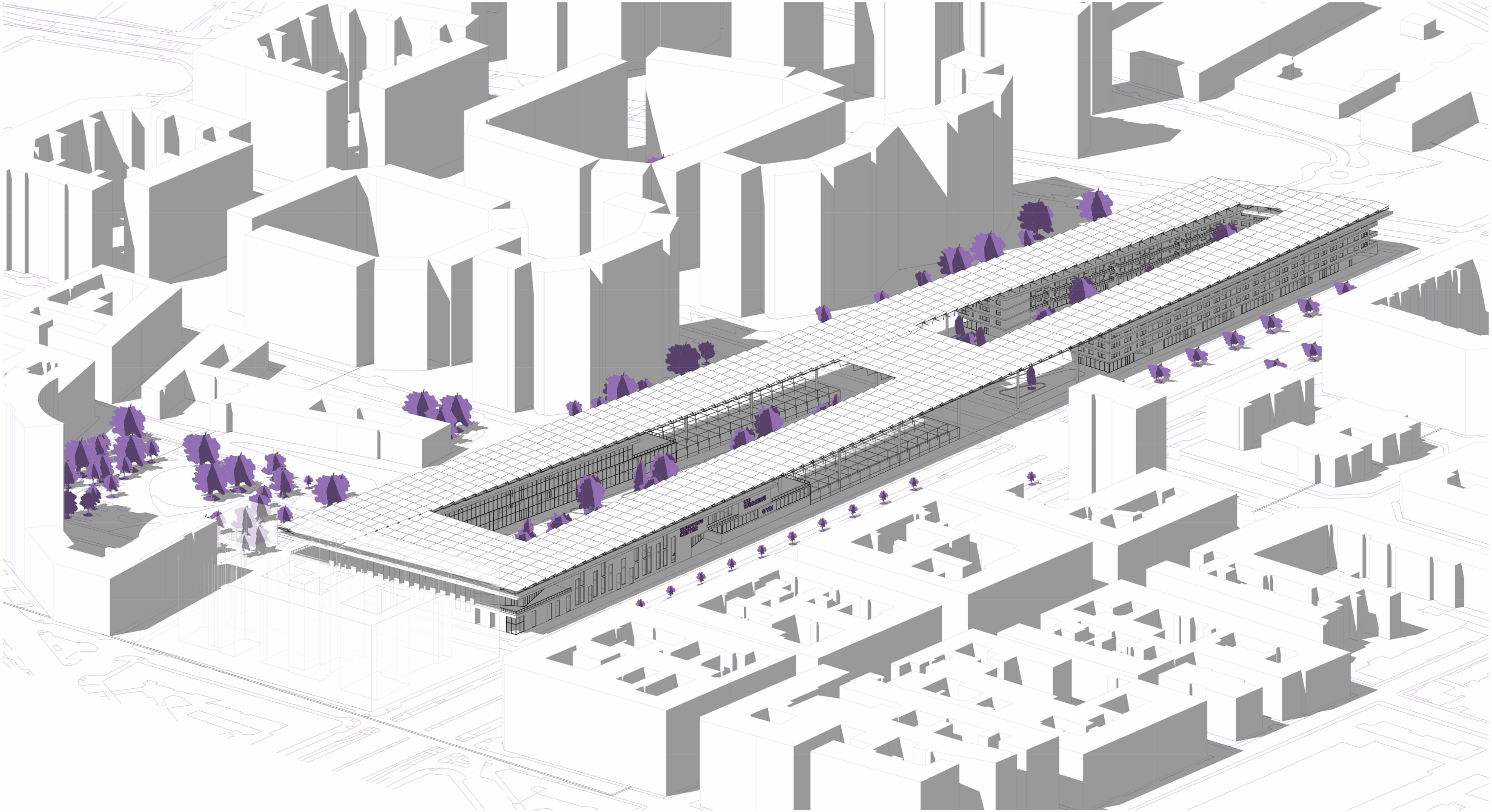
To unify two plots, considering an independent roof which is covering all the plots and the street in the middle, with this move we unite the two buildings in one single form.



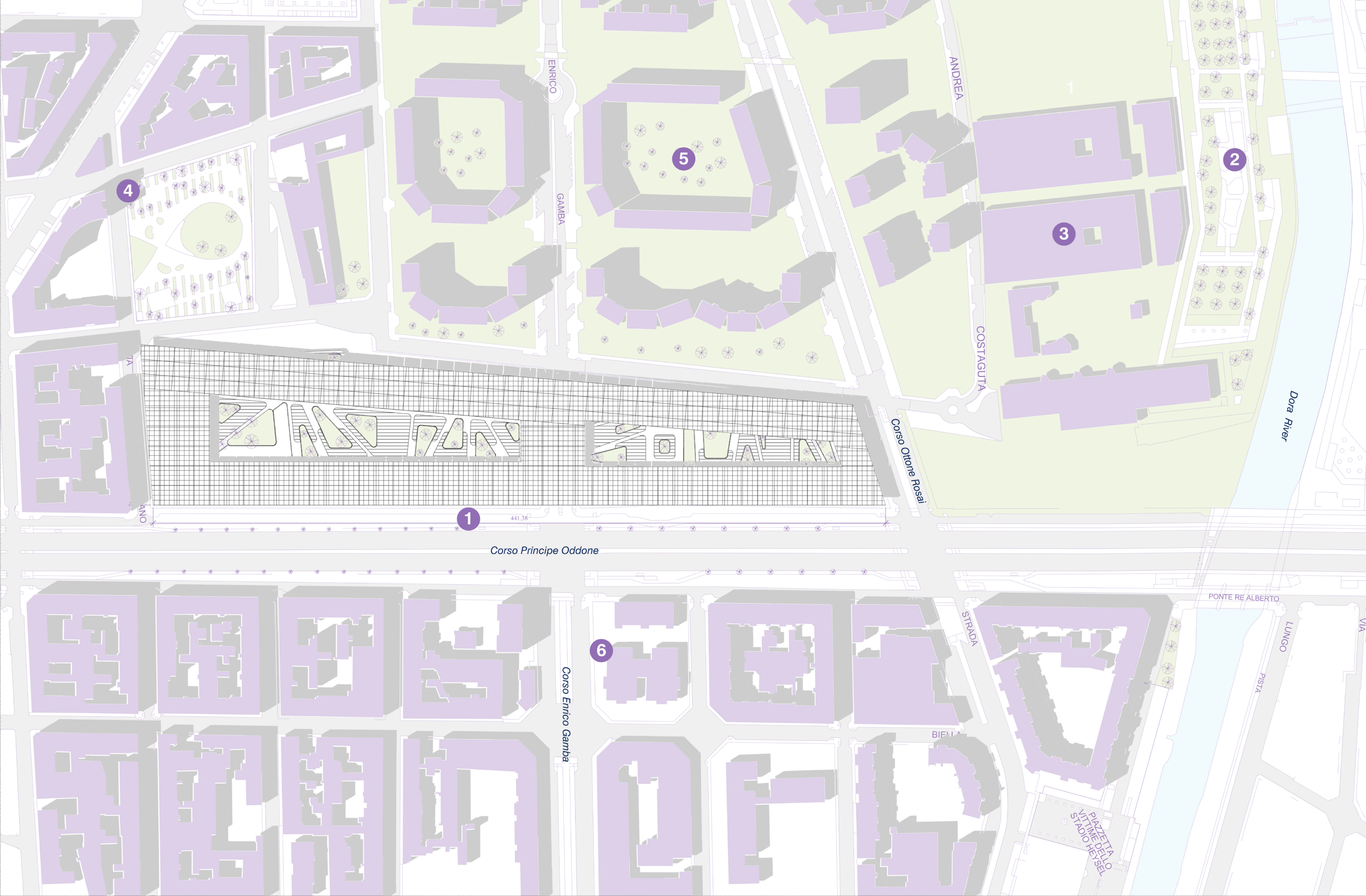
**STEP 8**

The portions of the roof which covered courtyards have removed and the result is two extraordinary outdoor spaces.

## Axonometric View



*Annex B.1: Axonometric View*
*Source: Author*



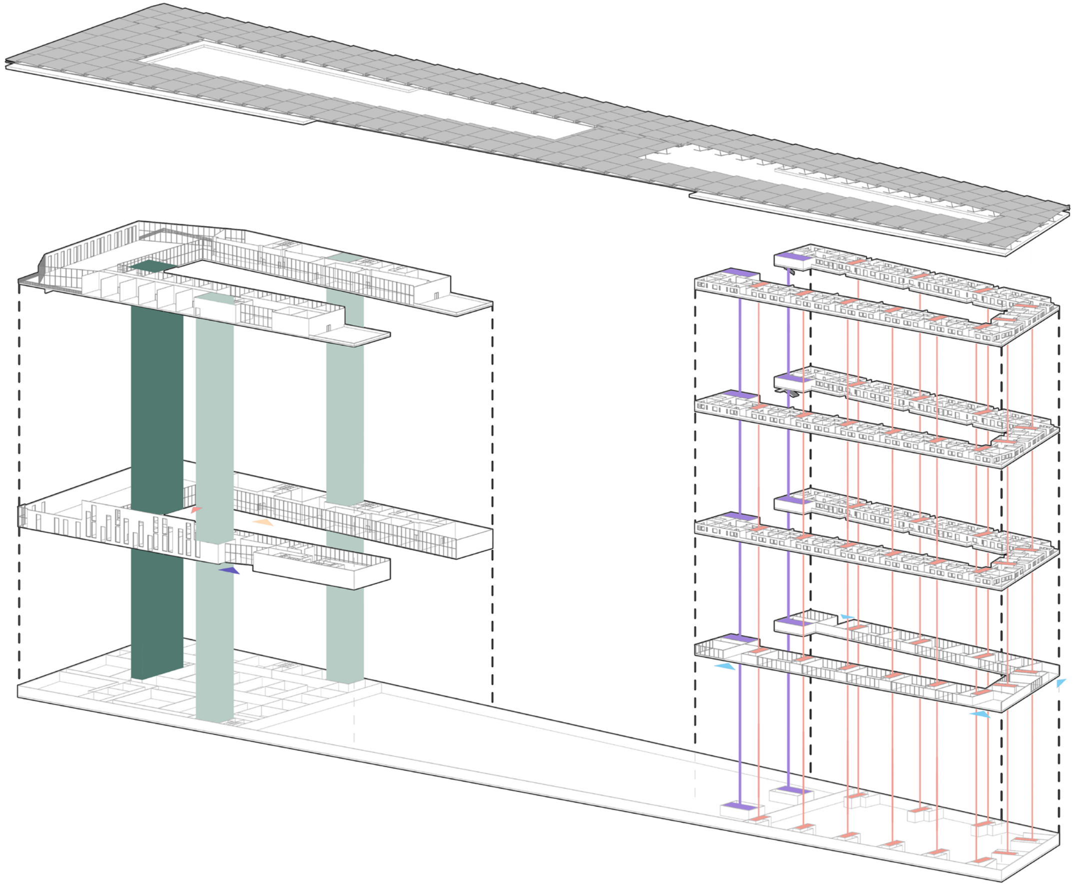

**Site Plan**

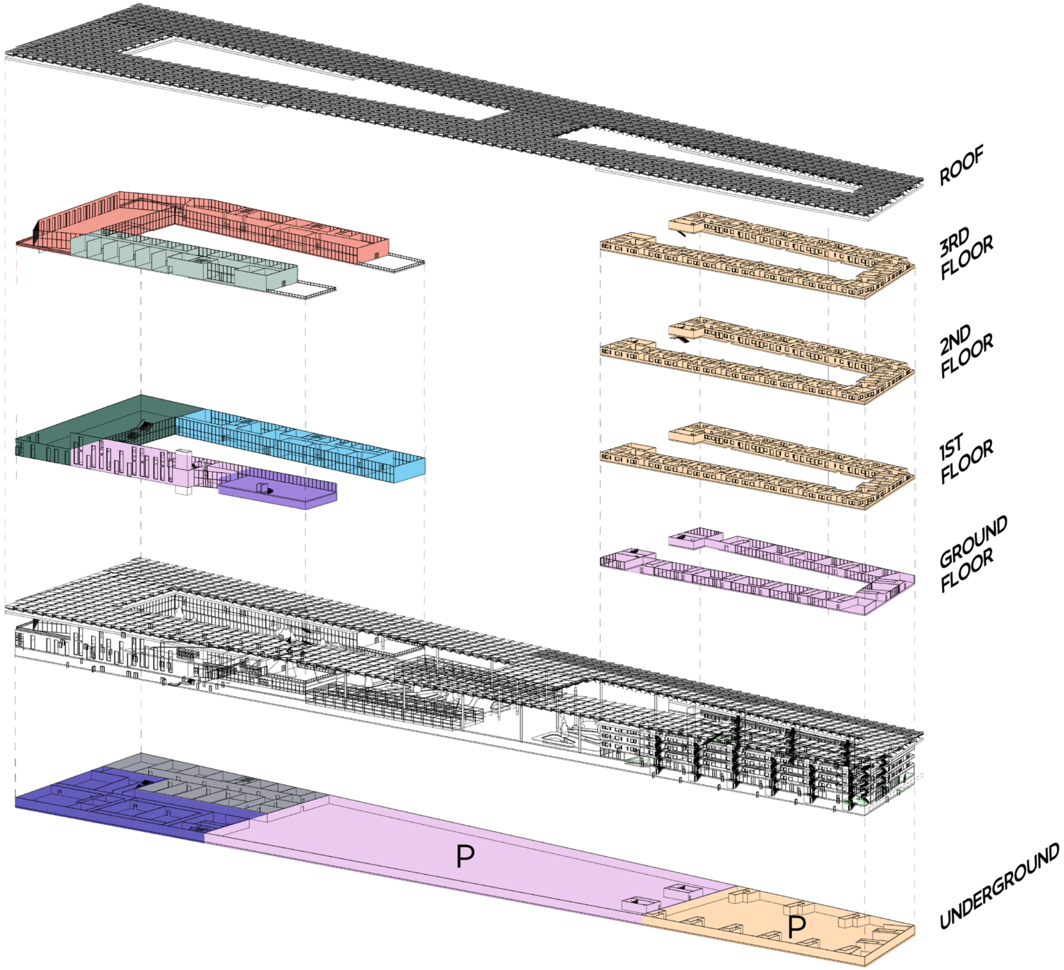
1 Mixed-use Building
2 Parco Dora
3 Environment Park
4 Giardino via Macerata
5 Residential Buildings
6 Public Educational Institution

Scale : 1: 1000

*Annex B.2: Site Plan*
*Source: Author*

## Exploded Diagrams



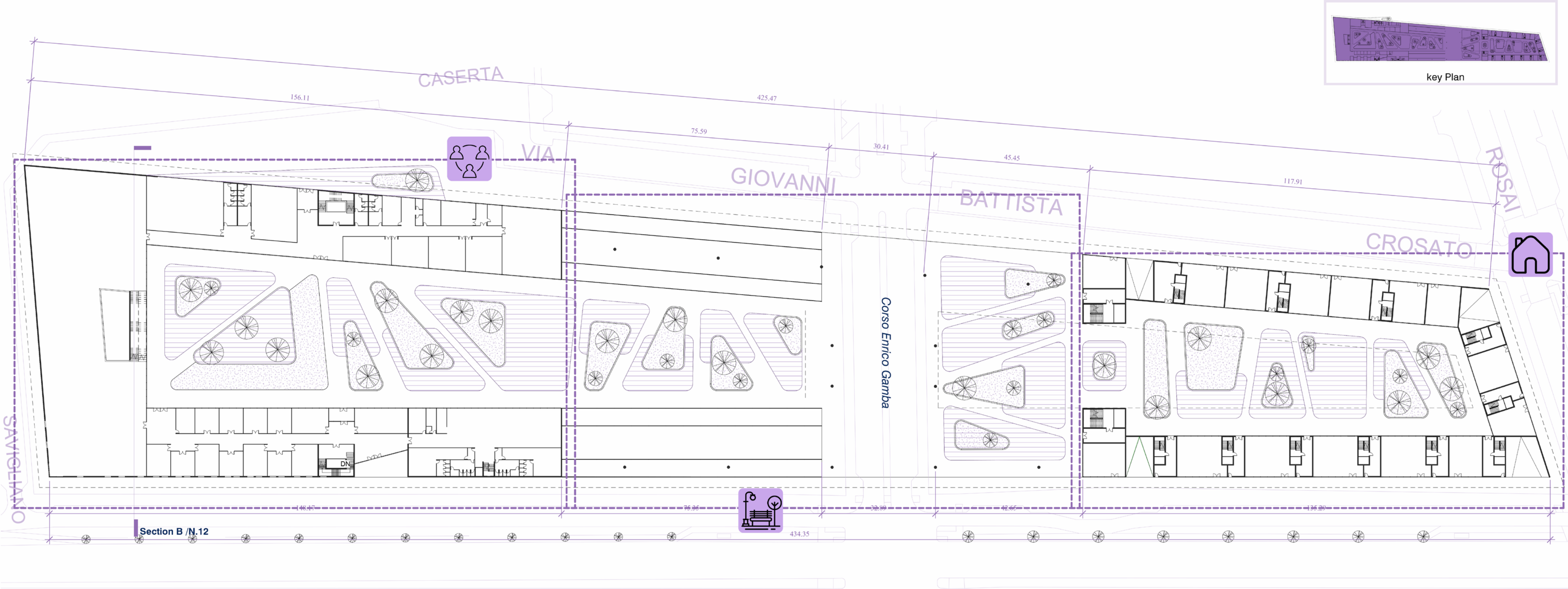



**Accesses**

- **Cinema / Exhibition / CoWorking** — Access from cinema to exhibition and coworking spaces
- **Residential** — Access from residential parkings to the residential units
- **Offices / CoWorking / Educational** — Access from parking to the commercial, offices, educational, and cowrking
- **Commercial / Residential** — Access from the public parking to the commercial and residential
- Parkings' entrance
- Commercial and Gym entrance
- Exhibition entrance
- Educational entrance

- **Residential** — Private units and Co-housing, 9300 sqm
- **Commercial** — 30 commercial units, 2900 sqm
- **Educational** — 2300 sqm
- **Exhibition** — 2600 sqm
- **Co-working** — 4000 sqm
- **Offices** — 19 private offices, 1300 sqm
- **Gym** — 900 sqm
- **Cinema** — 4 cinema and theater halls, 2000 sqm
- **Storage** — 2500 sqm
- **Residential Parking** (P) — 5400 sqm
- **Public Parking** (P) — 15000 sqm

*Annex B.3: Functions diagram and  Vertical Accesses diagram*
*Source: Author*

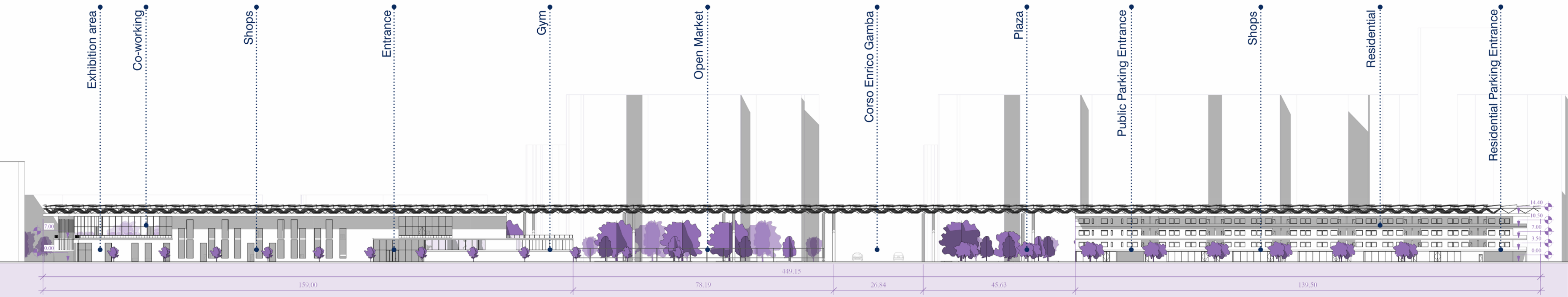



Ground Floor Plan Scale 1:500

Residential

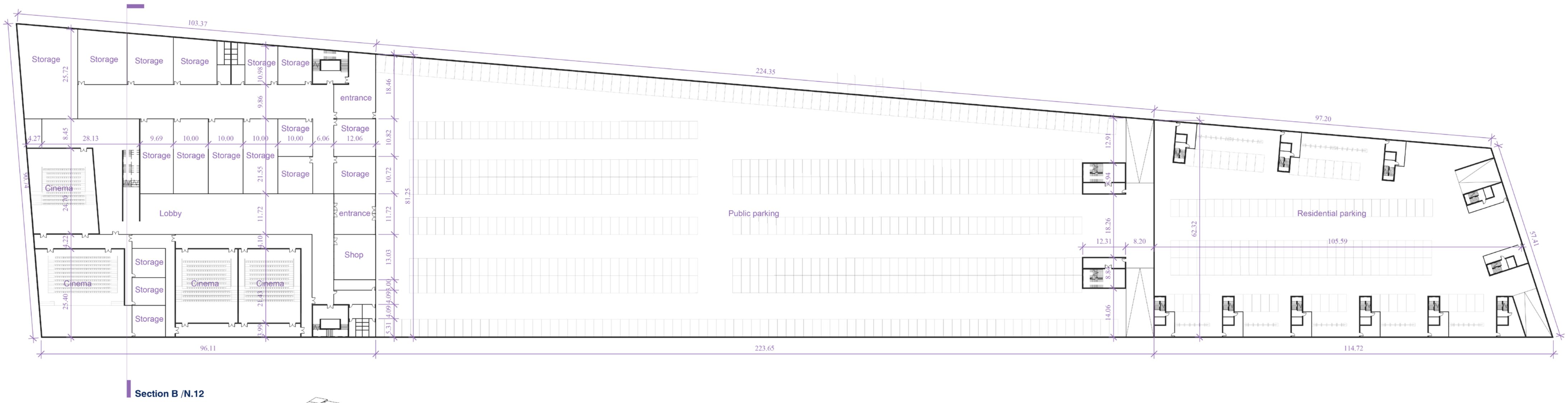
Public Open space and Open Market

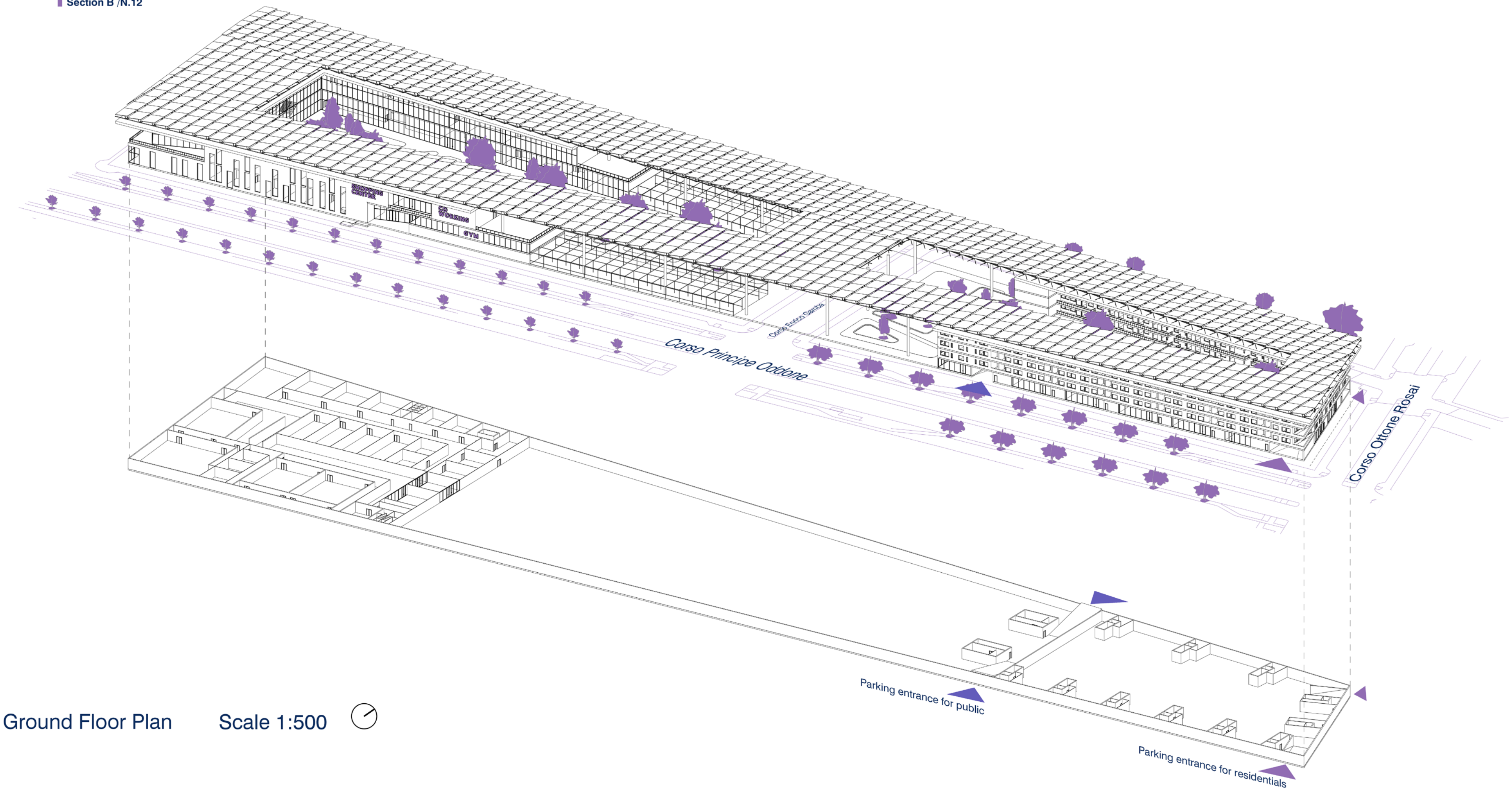
Commercial and Public Spaces




South Elevation Scale 1:500

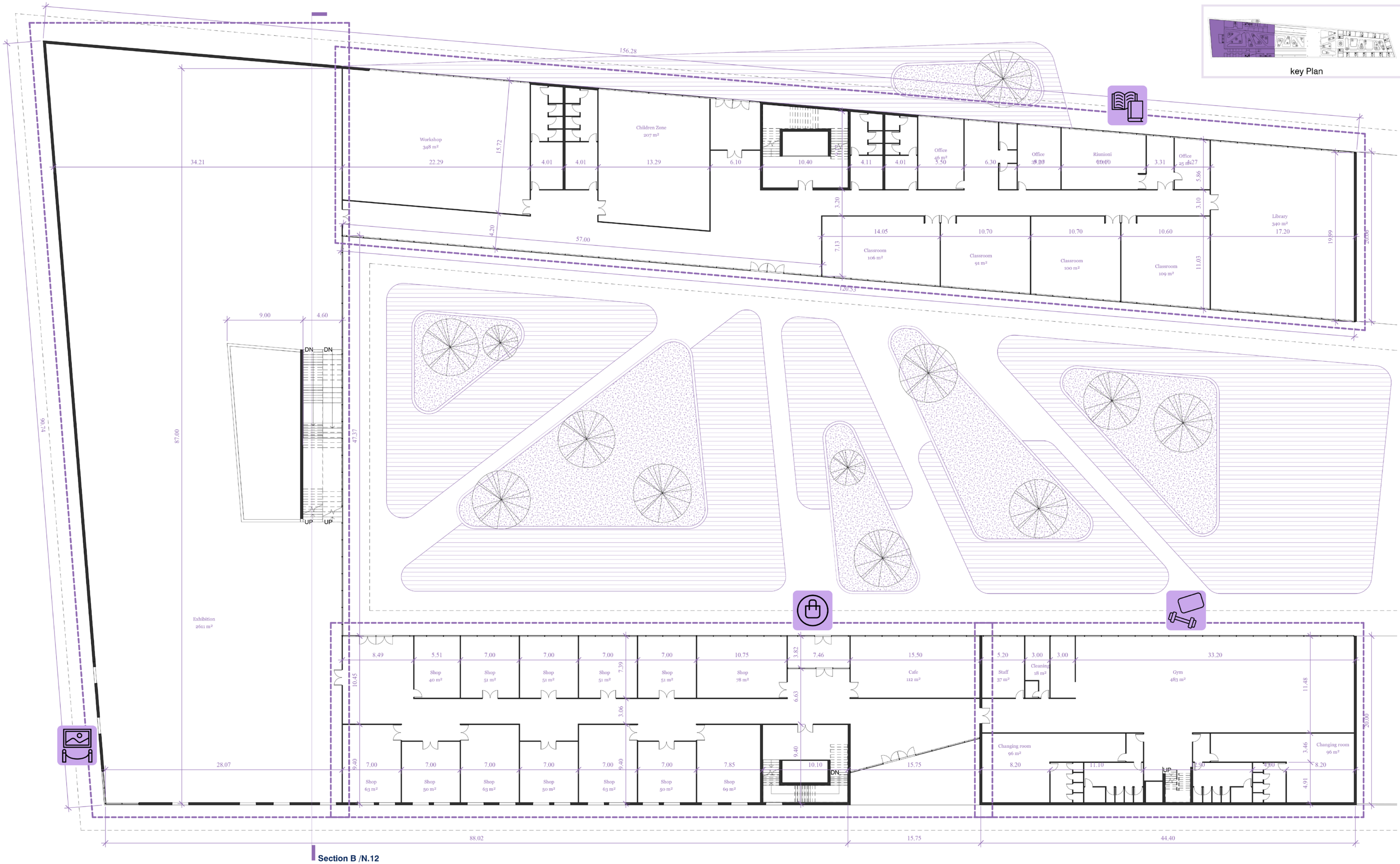
*Annex B.4: Ground floor plan and South Elevation*
*Source: Author*




Under Ground Floor Plan Scale 1:500

*Annex B.5: Underground floor plan and Axonometric view for parking accessibilities*
*Source: Author*




Ground Floor Plan Scale 1:200

Exhibition Hall

Educational
( Classrooms, Workshop, Library, Offices, Children Zone)

Gym

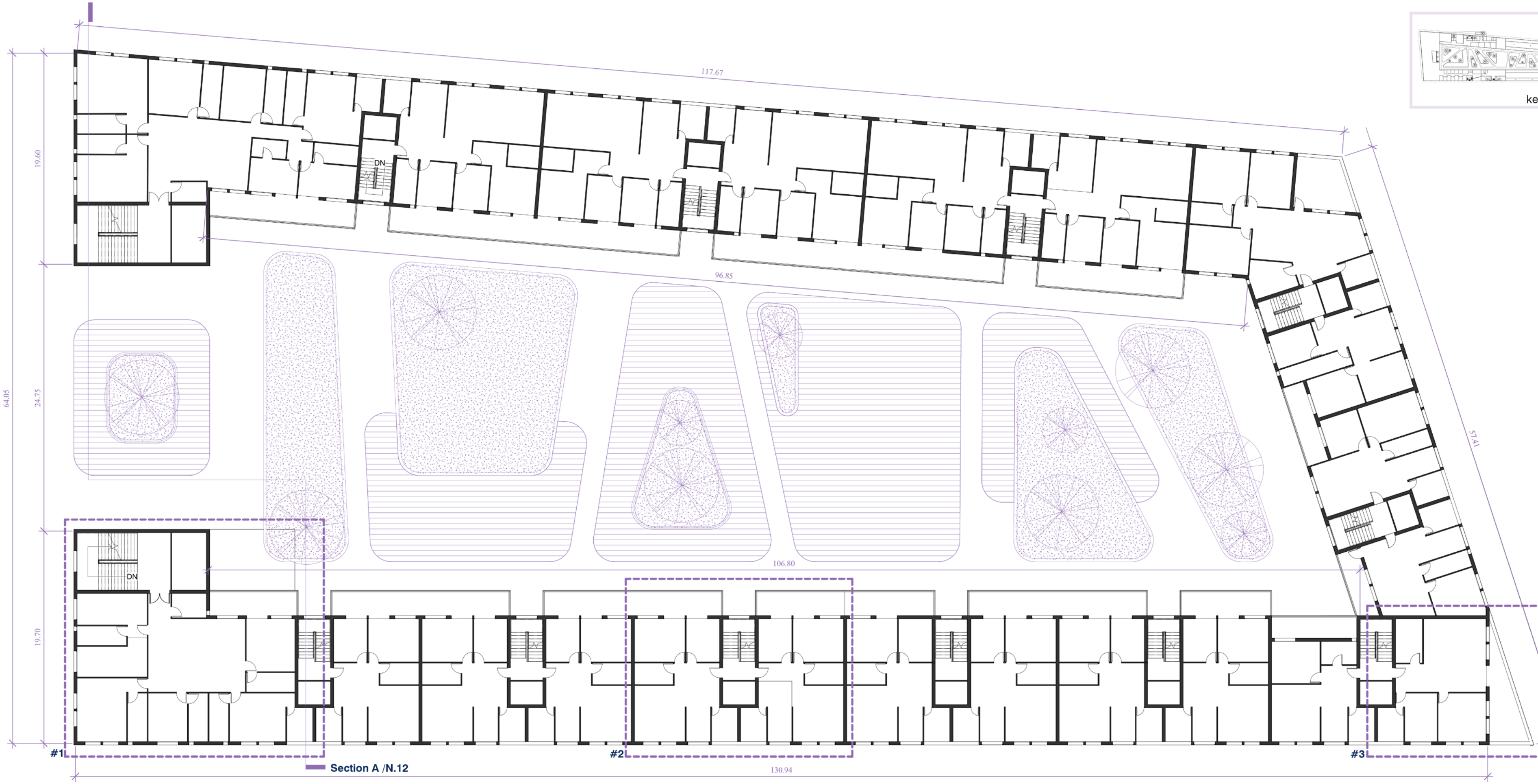
Shops

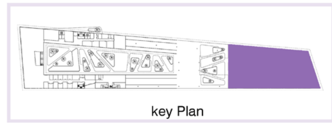
*Annex B.6: Ground floor plan ( south part)*
*Source: Author*


First Floor Plan Scale 1:200

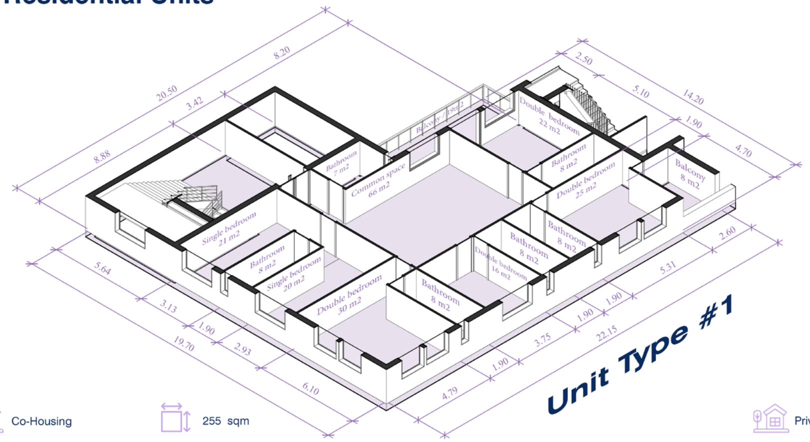
Co-working

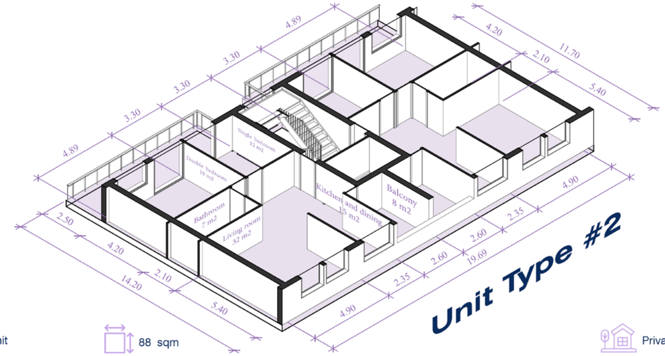
*Annex B.7:  First floor plan ( south part)*
*Source: Author*

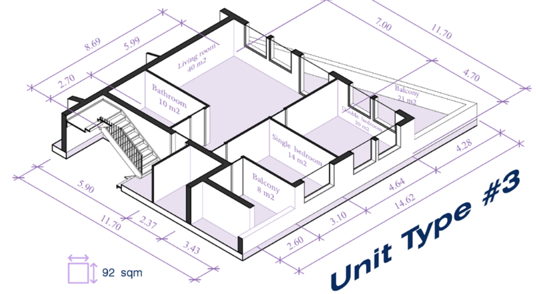



## Residential Units




**Unit Type #1**

- Co-Housing
- 255 sqm
- 2 Single bedrooms<br>4 Double bedrooms
- 2 Units in each floor
- 1 Balcony with Street View<br>1 Balcony with Yard View
- 7 Locali

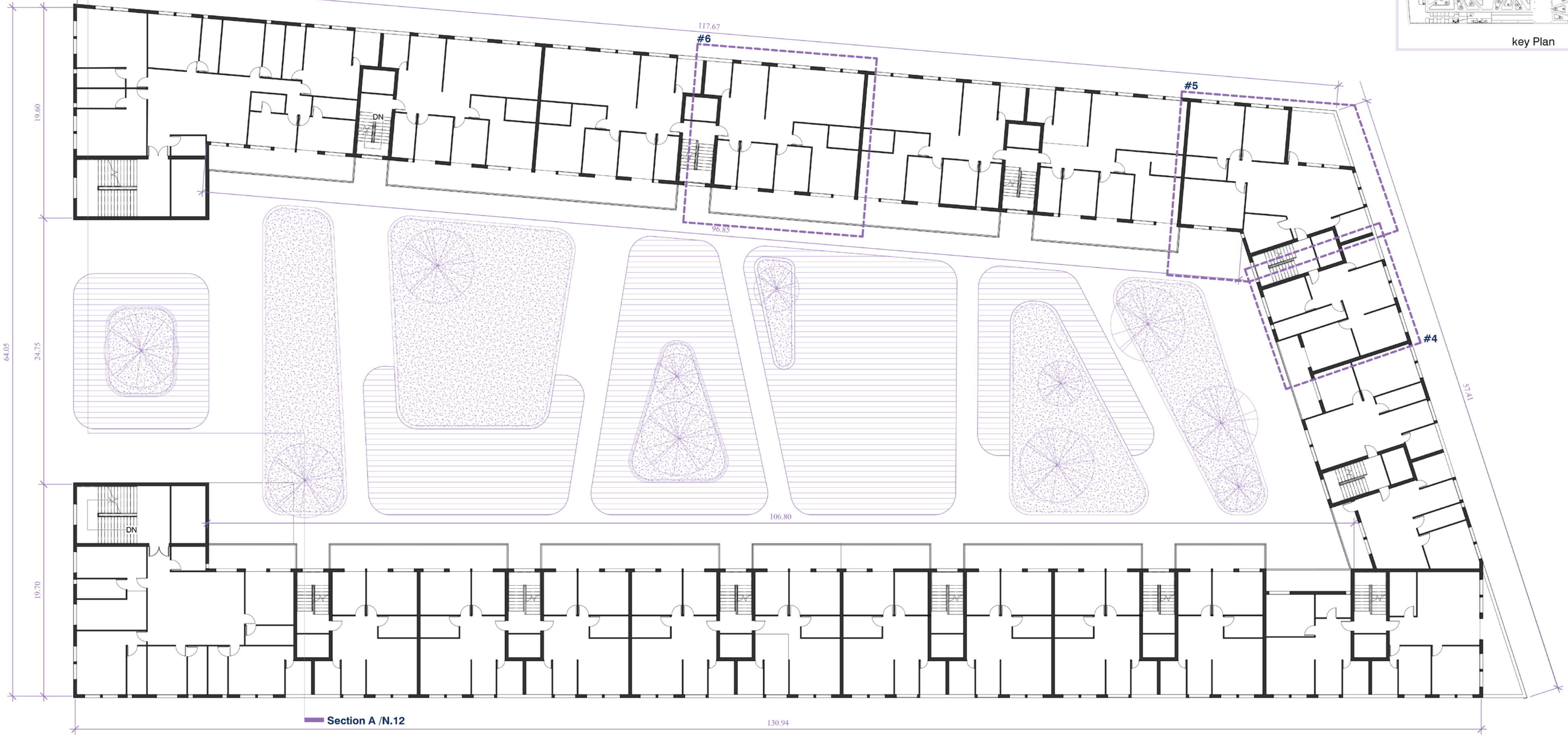
**Unit Type #2**

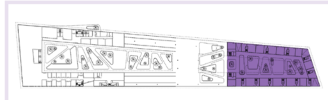
- Private Unit
- 88 sqm
- For a Family of 3
- 10 Units in each floor
- 1 Balcony with Street View<br>1 Balcony with Yard View
- 4 Locali

**Unit Type #3**

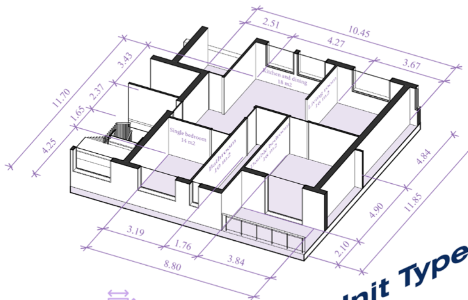
- Private Unit
- 92 sqm
- For a Family of 3
- 1 Units in each floor
- 1 Balcony with Street View
- 4 Locali

*Annex B.8: Residential floor plans and units(North part)*
*Source: Author*




## Residential Units



Unit Type #4

Private Unit

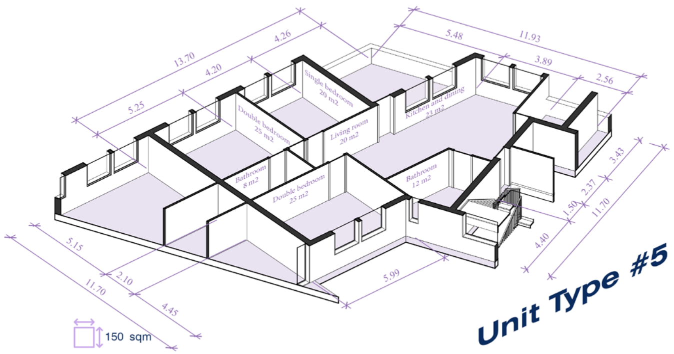
88 sqm

1 Single bedrooms
1 Double bedrooms

2 Units in each floor

1 Balcony with Street View
1 Balcony with Yard View

5 Locali



Unit Type #5

Private Unit

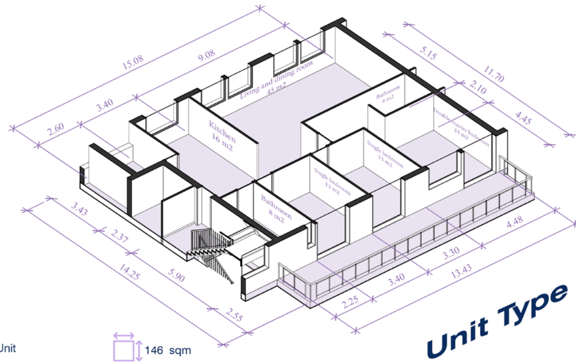
150 sqm

1 Single bedrooms
2 Double bedrooms

1 Units in each floor

2 Balcony with Street View

6 Locali



Unit Type #6

Private Unit

146 sqm

For a Family of 4

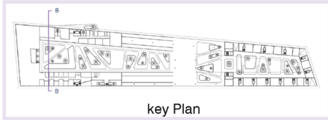
5 Units in each floor

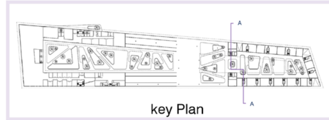
1 Balcony with Street View
1 Balcony with Yard View

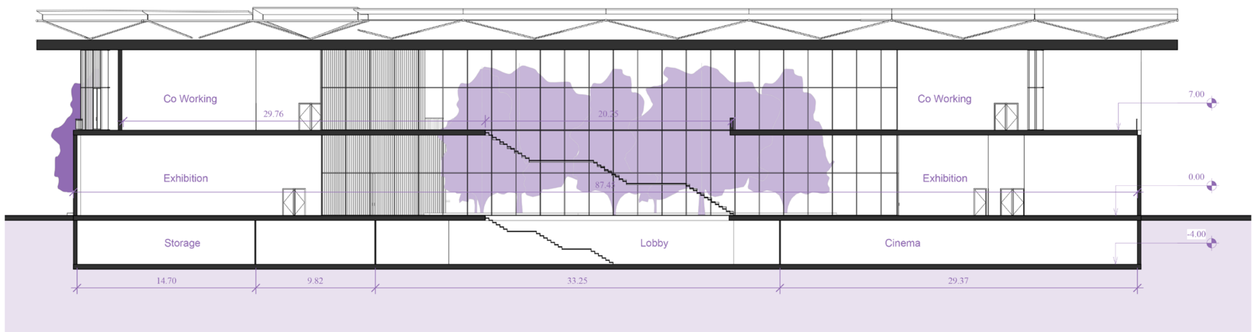
6 Locali

*Annex B.9: Residential floor plans and units(North part)*
*Source: Author*

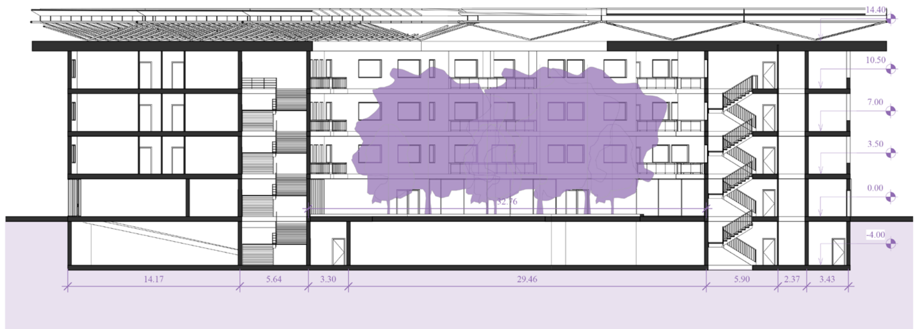
## Sections



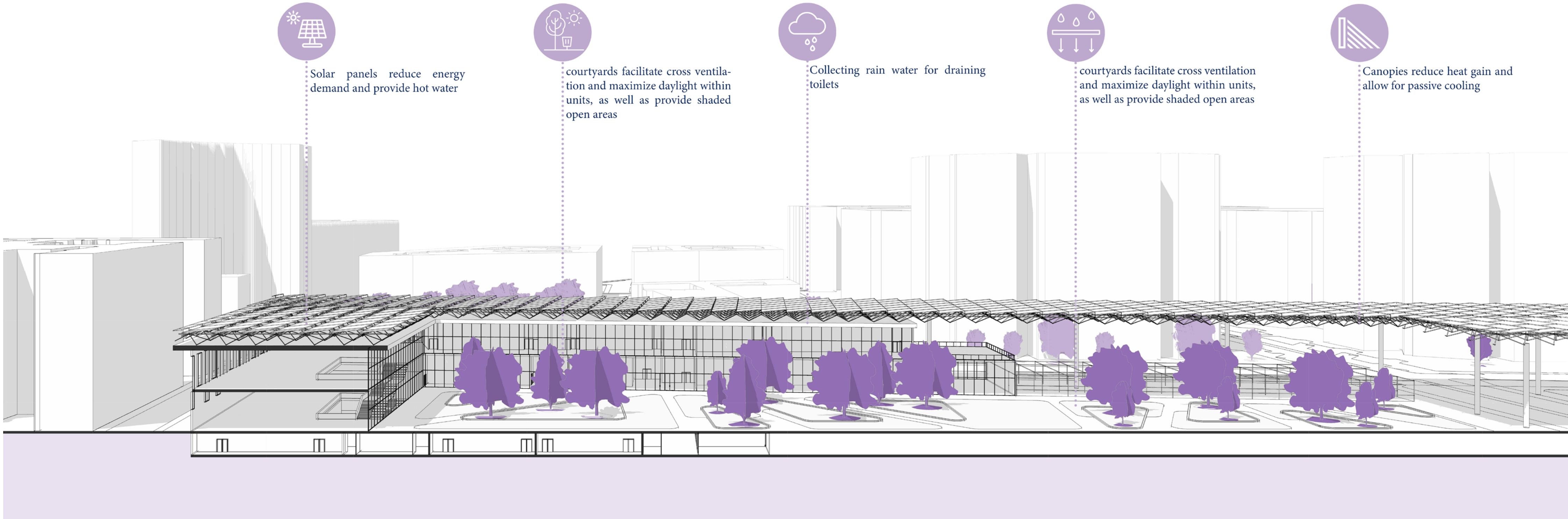




Section B-B Scale 1:200



Section A-A Scale 1:200

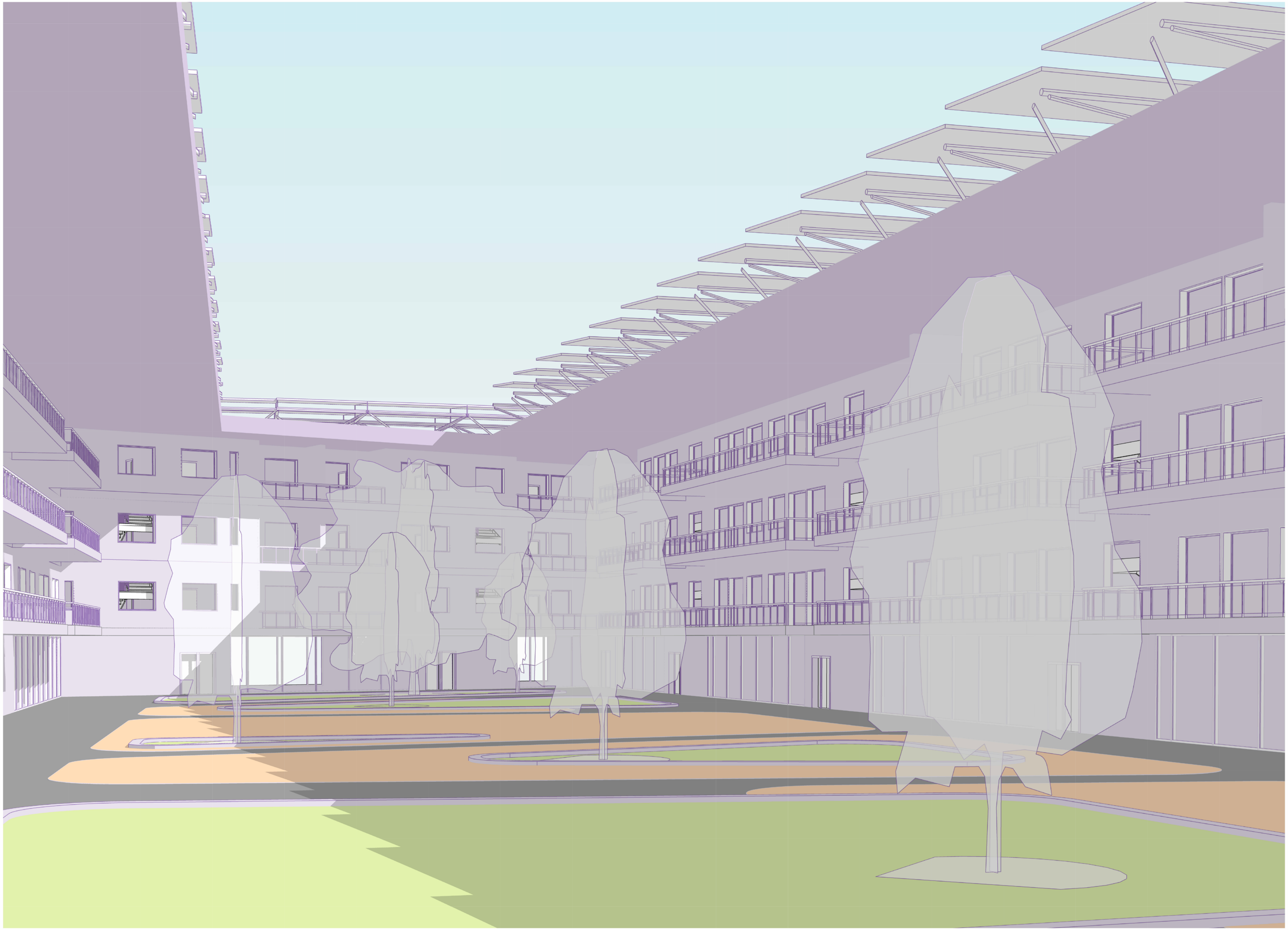



Section perspective for sustainable strategies

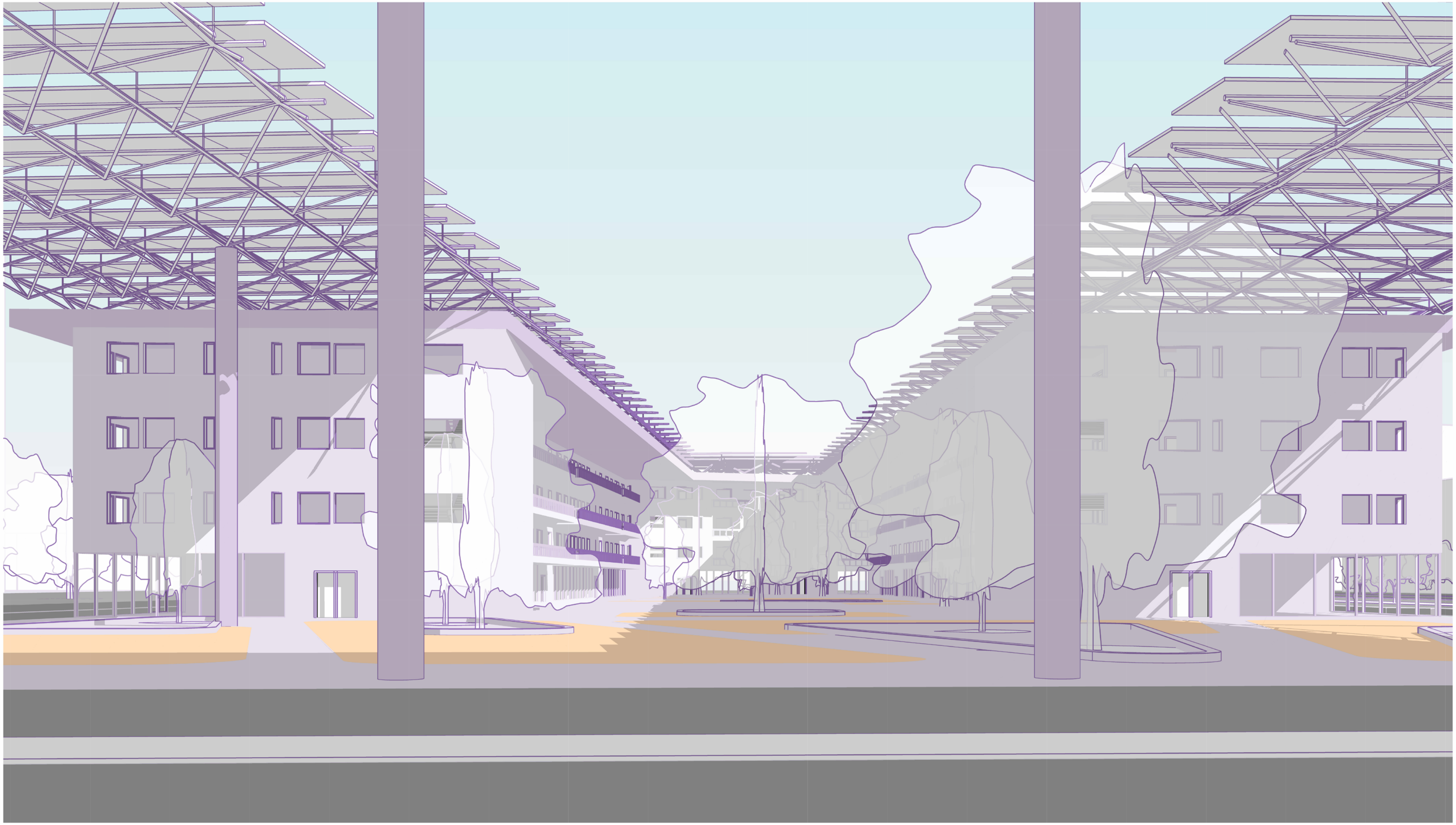
*Annex B.10: Building Sections and Section perspective for sustainable strategies*
*Source: Author*


SHOPPING CENTER
CO WORKING
GYM

*Annex B.11: 3 D view from Corso Principe Oddone*
*Source: Author*



*Annex B.12: 3 D view from the Courtyard of Residential*
*Source: Author*



*Annex B.13: 3 D view from Corso Enrico Gamba*
*Source: Author*

Chapter Six

# Conclusion And Recommendations

*Illustrations: Ana María Ospina*

The synthesis of this thesis intricately intertwines theoretical foundations, empirical case studies, and a preliminary design proposal, advocating for the transformative potential of self-sufficient neighborhoods and mixed-use architecture. The selection of case studies has been carefully curated from diverse global contexts, considering self-sufficient characteristics and how each case uniquely responded to them based on inherent potentials and vulnerabilities. These case studies serve as exemplars, demonstrating the diverse ways self-sufficiency principles can be tailored to specific contexts, offering valuable insights into the interplay between architecture, sustainability, and community dynamics.

The integration of mixed-use buildings adds another layer of complexity and innovation to the self-sufficiency framework. Compact mixed-use buildings were also examined, shedding light on their potential to contribute to the overarching goal of self-sufficiency. These structures, through their efficient spatial design and multifunctional nature, hold promise for promoting self-reliance while fostering social interactions and communal vitality.

Crucially, the design aspect of this thesis, presented as a preliminary proposal, serves as a tangible demonstration of how theoretical knowledge can be translated into an implemented result in the real world. It symbolizes a step towards practical realization, illustrating how the principles of self-sufficiency and mixed-use architecture can be woven into urban environments. This design proposal encapsulates not only the spirit of innovation but also the potential for positive impact on communities, shaping the urban landscape into a sustainable, harmonious entity.

## Rationale for Selecting Turin for the Preliminary Design Proposal for this thesis

The choice of Turin as the focal point for the design proposal within this thesis is deliberate and based on the synergy between Turin's urban landscape and Italy's commitment to the Sustainable Development Goals (SDGs). This alignment presents a compelling context for advancing the principles of self-sufficient neighborhoods and mixed-use architecture.

1. Alignment with the 2030 Agenda for Sustainable Development: Turin, like numerous global cities, has embraced the United Nations' 2030 Agenda for Sustainable Development. This international commitment encompasses 17 Sustainable Development Goals and 169 targets, which serve as a blueprint for global sustainability until 2030. By centering this thesis in Turin, we bridge the gap between global objectives and local actions, emphasizing the pivotal role of cities in achieving these goals.

2. Responding to Post-Pandemic Challenges: The emergence of the COVID-19 pandemic has profoundly impacted urban life. Turin, like many cities worldwide, faces the dual challenge of post-pandemic recovery and the imperative to build resilience against future crises. The design proposal outlined herein offers a pragmatic approach to urban recovery, incorporating self-sufficient neighborhoods and mixed-use architecture to strengthen the city's preparedness for future challenges.

3. Fostering Local Engagement: The design proposal inherently promotes community involvement by focusing on local needs and aspirations. It acknowledges that achieving sustainability necessitates active participation from all strata of society. This thesis aligns with the principle that local choices and leadership are indispensable in driving sustainable urban development.

4. Demonstrating Tangible Impact: This design proposal serves as a real-world manifestation of sustainable urban development. By offering

a practical blueprint for a mixed-use building in Turin, it embodies the thesis's core argument that sustainability can be implemented on the ground. The proposal is poised to deliver tangible outcomes, directly contributing to Turin's progress towards the Sustainable Development Goals.

In summation, Turin emerges as an ideal canvas for this design proposal, thanks to its commitment to the 2030 Agenda for Sustainable Development, the pressing post-pandemic challenges it grapples with, the opportunity to harness Recovery Fund resources effectively, the potential for robust community involvement, and the capacity to translate sustainability principles into concrete action. This choice underscores the pivotal role of cities like Turin in steering the world towards a more sustainable and resilient future, firmly rooted in the United Nations' global sustainability objectives.

## Rationale for Selecting Spina 3 District for the Preliminary Design Proposal for this thesis

The selection of the Spina 3 district in Turin, Italy, for the preliminary design proposal of a self-sufficient neighborhood and mixed-use building is underpinned by several compelling reasons, all of which contribute to the feasibility and significance of this choice within the context of Italy and the Sustainable Development Goals (SDGs).

1. Urban Regeneration Significance: Spina 3, also known as Quartiere Spina 3, represents a substantial urban regeneration project spanning approximately one million square meters. Historically, this area was dominated by disused industrial sites, including the Ferriere Fiat iron metallurgy plant, Michelin tire factory, Savigliano electrical and railway goods manufacturing, and Paracchi carpet factory. The closure of these industries left a void in Turin's industrial landscape, resulting in significant job losses. This choice aligns perfectly with the ethos of self-sufficient neighborhoods, which often focus on revitalizing and repurposing post-industrial spaces into thriving, sustainable communities.

2. Repurposing Post-Industrial Space: The inception of the Spina 3 transformation project coincided with the closure of these industrial facilities. Turin's municipal authorities embarked on an ambitious redevelopment program to reinvigorate the area. This dovetails with the fundamental concept of self-sufficiency, emphasizing the adaptive reuse of existing infrastructure and resources to create self-reliant communities.

3. Diverse Functional Integration: The Spina 3 redevelopment project is characterized by its inclusive approach to urban planning. It envisions a neighborhood that seamlessly integrates a wide spectrum of functions, including residential, commercial, office, research, production, and recreational spaces. This harmonious coexistence aligns with the principles of mixed-use architecture, a central tenet of self-sufficient neighborhoods, aiming to reduce the necessity for extensive commuting and fostering self-reliance among residents.

4. Community-Centric Approach: A notable aspect of the Spina 3 project is its commitment to accommodating the needs and aspirations of both longstanding residents and newcomers. The project's planners recognized the importance of addressing the community's expectations, ranging from improved public services to cultural and recreational amenities. This people-centric approach mirrors the essence of self-sufficient neighborhoods, where community input and engagement are central to shaping the neighborhood's design and functionality.

5. Architectural Landmarks: The Spina 3 redevelopment introduced significant architectural landmarks, including the Dora Commercial Park and the Santo Volto Church, a creation by renowned architect Mario Botta. These architectural focal points can serve as hubs for community interaction and engagement, fostering a sense of identity and place, which is vital for building a cohesive, self-sufficient neighborhood.

6. High-Density Urban Identity: Spina 3 provides a unique opportunity to

give urban identity to a high-density area, not only through architectural structures but also by accommodating a dense population. The design proposal for a self-sufficient neighborhood and mixed use building in this district aims to create an urban fabric that thrives on its density. It will foster social interactions, reduce the need for extensive commuting, and promote a vibrant urban lifestyle, all of which are aligned with the principles of self-sufficiency and sustainable urban development.

In conclusion, the choice of the Spina 3 district as the site for the preliminary design proposal holds substantial promise. It capitalizes on the area's rich urban regeneration significance, its potential for diverse functions, the availability of substantial financial resources, a community-oriented approach, the presence of architectural landmarks, and the valuable lessons it offers in navigating the challenges and opportunities of revitalizing post-industrial spaces. This makes Spina 3 an ideal canvas upon which to develop a blueprint for a sustainable, self-sufficient neighborhood, aligningwith Italy's aspirations towards the Sustainable Development Goals of 2030 and can show how the theoretical knowledge of this research can be implemented in the real life.

## Summary of the study

1. This thesis delves into the convergence of self-sufficient neighborhoods and mixed-use architecture as a response to urban challenges.

2. The proposal primarily demonstrates a preliminary design approach, showcasing how theoretical insights can guide practical application.

3. The thesis bridges the discourse on sustainable urban design, aligning self-sufficiency and mixed-use architecture.

4. The design proposal illustrates the potential of combining these concepts in real-world settings, particularly within high-density districts.

5. Self-sufficient neighborhoods harmonize energy, water, food, waste, and transportation systems, promoting autonomous and eco-conscious living.

6. Mixed-use buildings stand as pivotal enablers, optimizing land usage, stimulating local economies, and nurturing social cohesion.

7. A design proposal for Turin's Spina 3 forms a core part. Spina 3's redevelopment plan aims for urban revitalization, with significant government and EU funding backing its execution.

8. Detailed case studies, including "Melbourne 2030," are methodically examined, unveiling crucial sustainability dimensions.

9. The thesis bridges the discourse on sustainable urban design, aligning self-sufficiency and mixed-use architecture.

10. The design proposal illustrates the potential of combining these concepts in real-world settings, particularly within high-density districts.

11. The focus lies on augmenting facility networks encompassing public services, education, transportation, and cultural amenities.

12. By strategically aligning design elements with sustainability principles, the proposal aims to cultivate a vibrant urban community.

13. The proposal balances design creativity with the awareness that it remains at a preliminary stage, capturing essential directions for future detailed development.

In conclusion, the journey of this thesis—from theoretical exploration to case study analyses and a preliminary design proposal—advocates for the transformational potential of self-sufficient neighborhoods intertwined with mixed-use architecture. As urban landscapes confront evolving chal-

lenges, the insights derived from this study offer a pathway to sustainable and harmonious urban development, bridging the gap between theoretical ideals and tangible realities.
The design illustration for Spina 3 encapsulates the essence of translating theory into practice within a high-density context, embodying sustainability, community, and pragmatic potential.

## Benefits of the preliminary Design proposals for mixed-used building and self-sufficient community in Spina 3 Neighbourhood :

Let's attempt a preliminary comparison between the project proposal, albeit on a preliminary scale, and the theoretical studies referred to in the first chapters. The question that spontaneously arises is: Does the project manage to meet the requirements necessary for a 'self-sufficient community' in the considered area?

This response will involve a preliminary survey of residents and stakeholders. However, as intended, the project aims to address some of the priority issues that emerged from the theoretical analysis, including the following references:

A Modern Landmark: The proposed mixed-use building serves as a modern landmark for the district, enhancing its identity and marking a transition from its industrial past to a vibrant and forward-looking community.

Height and Horizon Harmony: The design respects the surrounding buildings' height, ensuring that the new structure seamlessly fits into the district's skyline, enhancing the visual cohesiveness of the neighborhood.

Integration and Accessibility: The integrated building design seamlessly connects the commercial and residential areas while preserving the street's accessibility. This promotes a sense of cohesion and convenience for residents and visitors, ensuring that the neighborhood functions as a unified community.

Community Space: The central square and meeting place provide residents with a dedicated communal space, nurturing a strong sense of community and encouraging social interactions, ultimately contributing to residents' well-being.

Supporting the 15-Minute City: The proposal aligns with the concept of a 15-minute city by optimizing land use, minimizing commuting needs, and promoting self-sufficiency within the neighborhood, reducing its ecological footprint.

Wanting to continue the reasoning, let's try to make a comparison between the contents of the project and the priorities expressed in chapter two as important elements for a self-sufficient community:

The first consideration pertains to energy conservation and reducing energy costs for both the building and the surrounding neighborhood. This objective factored into the decision to choose the roof type, allowing for the installation of solar panels across its entire surface. This choice ensures significant energy generation for planned building activities and, potentially, for co-generation investments benefiting the surrounding neighborhood and public spaces. It's worth noting that this choice, subject to detailed specialist studies, aligns with the principles outlined in Chapter 2 concerning reducing building energy dependence and achieving a 'net-zero energy system.'

The second reflection focuses on the 'people-centered district' concept. Within this context, we find the decision to allocate public space between the two buildings, which will offer accessible community services. In the final design, consideration could also be given to the inclusion of primary health centers, aligning with the concept of the '15-minute city.'

The third reflection centers on the use of water in communal areas and the potential for co-generation and water reuse in the final project phase. Although this matter requires specialist technical studies, scientific experiences have demonstrated its feasibility.

Last, but not least, is the social and anthropic question. The project of a building - which while respecting the pre-existing urban planning in the surrounding neighbourhood - presents itself - in terms of shape and services offered to the community - as an element of modern architecture, conferring an element of "personality" or landmark to the neighborhood. This, together with the role of the square between the buildings as an element of aggregation, aims to also address the important socio-anthropic issues that constitute the debate on the self-sufficient community.

In conclusion, these benefits collectively underscore the value of our preliminary design proposal. They demonstrate how this design not only enhances the physical landscape of Spina 3 but also enriches the quality of life for its residents and contributes to the sustainable development of the entire neighborhood.

## Recommendations for future research

Future research opportunities in the realm of self-sufficient neighborhoods and mixed-use architecture include:

**Holistic Urban Planning:** Investigate integrated planning approaches that harmonize self-sufficiency principles and mixed-use design, fostering resilient and sustainable urban environments*[Reference: RECONNECTING THE CITY WITH THE RIVERFRONT TO REVITALIZE THE SOCIO-ECONOMIC CONDITIONS OF SPRINGFIELD, MA ,A Thesis Presented By SNEHA RASAL ].*

**Interdisciplinary Collaboration:** Investigate the potential benefits of collaborative efforts between urban planners, architects, environmental scientists, and sociologists to create holistic self-sufficient neighborhoods.

**Long-Term Impact Assessment:** Conduct long-term studies to assess the actual effects of self-sufficient neighborhoods on resource conservation, community well-being, and economic resilience.

**Smart Technology Integration:** Explore the integration of advanced technologies, such as IoT, data analytics, and AI, to enhance the efficiency and sustainability of mixed-use buildings and their impact on self-sufficiency.

**Cultural Context:** Investigate how cultural factors influence the implementation of self-sufficiency principles and mixed-use architecture, ensuring that designs align with local traditions and values.

**Economic Viability:** Conduct comprehensive economic assessments to evaluate the financial sustainability of self-sufficient neighborhoods, considering factors such as property values, maintenance costs, and potential economic benefits.
**Adaptive Reuse Strategies:** Explore innovative ways to repurpose existing buildings and infrastructure within neighborhoods, aligning them with self-sufficiency goals while preserving historical and cultural significance.

**Education and Awareness:** Research the effectiveness of educational programs and awareness campaigns in promoting sustainable practices within self-sufficient neighborhoods, fostering a culture of environmental responsibility.

**Global Context:** Compare and contrast the implementation of self-sufficient neighborhoods across different regions and cultures, identifying universal principles and region-specific adaptations.

**Impact of Industrial Revolution:** Study the historical connection between urban/suburban development, industrial revolution, and innovative changes in agriculture, transportation, and communication technologies to understand their effects on modern urbanization[Reference: Multifaceted perspective on North American urban development,Mohamad Kashef and Mervat El-Shafie].

These recommendations, informed by existing research, can advance our understanding of self-sufficiency, mixed-use design, and urban development challenges.

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