

Trends in Italian Multi-Family Housing Since 2010: Through the Lens of Balcony Design

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Abstract

As China's housing sector shifts toward high-quality development, balconies have become a key focus in both policy discourse and professional practice. Drawing on user feedback and academic reflections on so-called "Fourth-Generation Housing", this study examines recent Italian multi-family housing, with a particular focus on balcony design, in order to provide references for housing development in China. The study adopts a combined methodology of sampling, typological analysis and statistical analysis, selects case projects since 2010 from representative Italian cities, including Rome, Milan and Turin, and conducts data analysis across three dimensions—project, dwelling unit, and balcony. At the same time, through a literature review on the evolution of Italian residential architecture, housing concepts, policies and regulations, and maintenance models, the study analyzes balcony characteristics from both residential and urban perspectives. On this basis, it systematically examines balcony design strategies. In light of current trends in China's housing development, the study proposes recommendations including greater attention to balcony design and research, the optimization of scientific regulatory measures, and the improvement of design and maintenance strategies.

Keywords: Italian residential architecture; Balcony; Design concepts; Regulation and maintenance; Fourth-generation housing

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Chapter 1 Introduction

1.1 Research Background

1.1.1 China's residential construction has entered a phase of high-quality development

The development of multi-unit housing in China is undergoing a paradigm shift from 'quantity' to 'quality', as per capita living space continues to increase and the quality of life for residents continues to improve. In May 2025, the revised 'Specifications for Residential Projects' (GB 55038-2025) raised standards for clear floor-to-ceiling heights, entrance door widths and floor sound insulation performance, thereby comprehensively enhancing the quality requirements for the residential environment^[1]. In December 2025, the Ministry of Housing and Urban-Rural Development issued the 'Opinions on Improving Housing Quality', promoting the refinement of housing construction standards, the widespread adoption of high-quality materials, the development of new construction methods, the strengthening of technological empowerment, and the improvement of industrial support^[2]. Against this backdrop, there is a need to further enhance the design, management and maintenance standards of residential buildings, comprehensively improve housing quality, and ensure that housing better meets the people's aspirations for a better life.

1.1.2 The Functional Role of Balconies is Evolving to Meet Diverse Residential Needs

To meet the diverse residential needs of this phase of high-quality development, the functional role of balconies in multi-unit residential buildings is gradually shifting. In particular, since the onset of the COVID-19 pandemic, the value of balconies in promoting ventilation and natural light, enhancing living standards, and fostering physical and mental well-being has been re-evaluated, thereby driving an update in residential concepts. On the one hand, the floor area of balconies has increased, making them a key element influencing the appearance of residential façades and the layout of floor plans; on the other hand, balconies are no longer confined to the single function of drying laundry, but are gradually taking on composite functions such as leisure, gardening, fitness and socialising^{[3][4]}, becoming a crucial entry point for enhancing residential

quality.

Various incentive measures for balcony design have been successively introduced across the country to drive innovation in residential balcony design. In 2023, Chongqing issued the ‘Detailed Rules for Pilot Projects on Vertical Greening in Residential Buildings in the Central Urban Area’, which allows eligible ‘open-plan, household-owned vertical greening courtyards’ to be excluded from floor area ratio calculations^[5]. The ‘Beijing Guidelines for the Design of High-Quality Commercial Residential Buildings (Trial)’ issued in 2024 promotes the creation of ‘residential balconies with rational design, diverse forms and varied settings, and encourages the installation of open balconies in multi-storey residential buildings’; it also ‘encourages the improvement of indoor and outdoor greening environments and the creation of garden-style residential communities through various measures, such as the pre-installation of planting troughs, planters and planting pools on balconies, and the provision of water supply and drainage facilities’^[6]. The Supplementary Provisions to the “Chengdu Urban Planning Management Technical Regulations (2024)”, issued in 2025, “support the provision of ancillary spaces such as balconies not exceeding 30% of the total floor area, and specify that enclosed balconies shall be calculated at half of their horizontal projected area for floor area ratio purposes”^[7]. The “Several Opinions on Further Promoting the Improvement of Residential Quality in the Municipality”, issued by Shanghai in 2025, expanded the scope of balcony areas eligible for half-floor area ratio calculation to “no more than 16 square metres”, whilst relaxing the depth restriction to 1.8 metres^[8]. A series of policy incentives have focused on balconies, encouraging the industry to explore innovative practices through measures such as adjusting floor area ratio calculation methods and relaxing restrictions on balcony area and depth.

At the same time, balconies have gradually become a focal point and key design element in “Good Housing” design competitions at all levels. In the 2023 National “Good Housing” Design Competition^[9], numerous winning entries from the Beijing and Nanjing regions incorporated greenery and natural light through their balconies. In the 2025 National “Good Housing” Design Competition^[10], numerous winning entries concentrated on innovating through balconies. The “New Three-Generation Home” proposal featured an age-friendly conservatory on the balcony to address the diverse needs of multi-generational cohabitation, whilst the “Core Courtyard” proposal introduced sunlight and views via a two-storey, double-height, embedded vertical

courtyard, thereby carrying forward the concept of “Eastern courtyard living”.

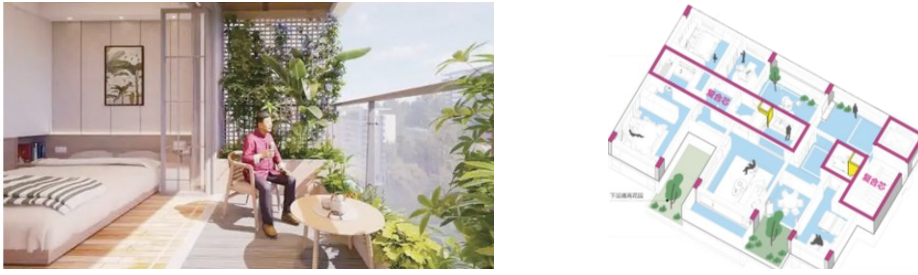


Figure 1.1 Several winning designs from the 2025 National "Good House" Design Competition focused on innovation in balcony space. (Source: <https://www.news.cn/>, <https://news.bjd.com.cn/>)

1.1.3 The practice of large-scale balconies advocated by “Fourth-Generation Housing” has attracted attention

Against a backdrop of increasingly diverse balcony functions and policy measures encouraging innovation, so-called “Fourth-Generation Housing”—characterised by large, open balconies—has attracted attention. From the 71st City Forest Garden in Chengdu, Sichuan, to the Jingye Home Vertical Forest Complex in Huanggang, Hubei, and from Guangzhou to Harbin, the construction of such housing has been undertaken across the country. With the core design philosophy of “a balcony for every household and a courtyard for every home”, “Fourth-Generation Housing” has, to some extent, improved living standards by increasing balcony dimensions and expanding the ratio of balcony area to total floor area, thereby enhancing the net usable floor area of dwellings. However, in practice, these developments have gradually revealed problems and sparked controversy. For instance, in some projects, balconies project too far, affecting natural



Figure 1.2 Recent practice of "fourth-generation housing" in China (Source: www.toutiao.com/)

light inside the home; misaligned balcony positions cause visual intrusion; and balcony designs fail to account for practical needs such as storage space. Issues such as unauthorised extensions and neglected greenery have also arisen, making it difficult to

achieve the intended design outcomes. From a design perspective, such housing disregards the climatic characteristics of different regions and the quality requirements of green building, contravening the national strategy of sustainable development. Furthermore, the sharp increase in the proportion of balcony space resulting from the indiscriminate relaxation of area calculation standards has disrupted the scientific and rational design principles and technical logic of residential architecture.

1.1.4 The evolution of balcony design in Italian residential buildings in recent years reflects a shift in living philosophies

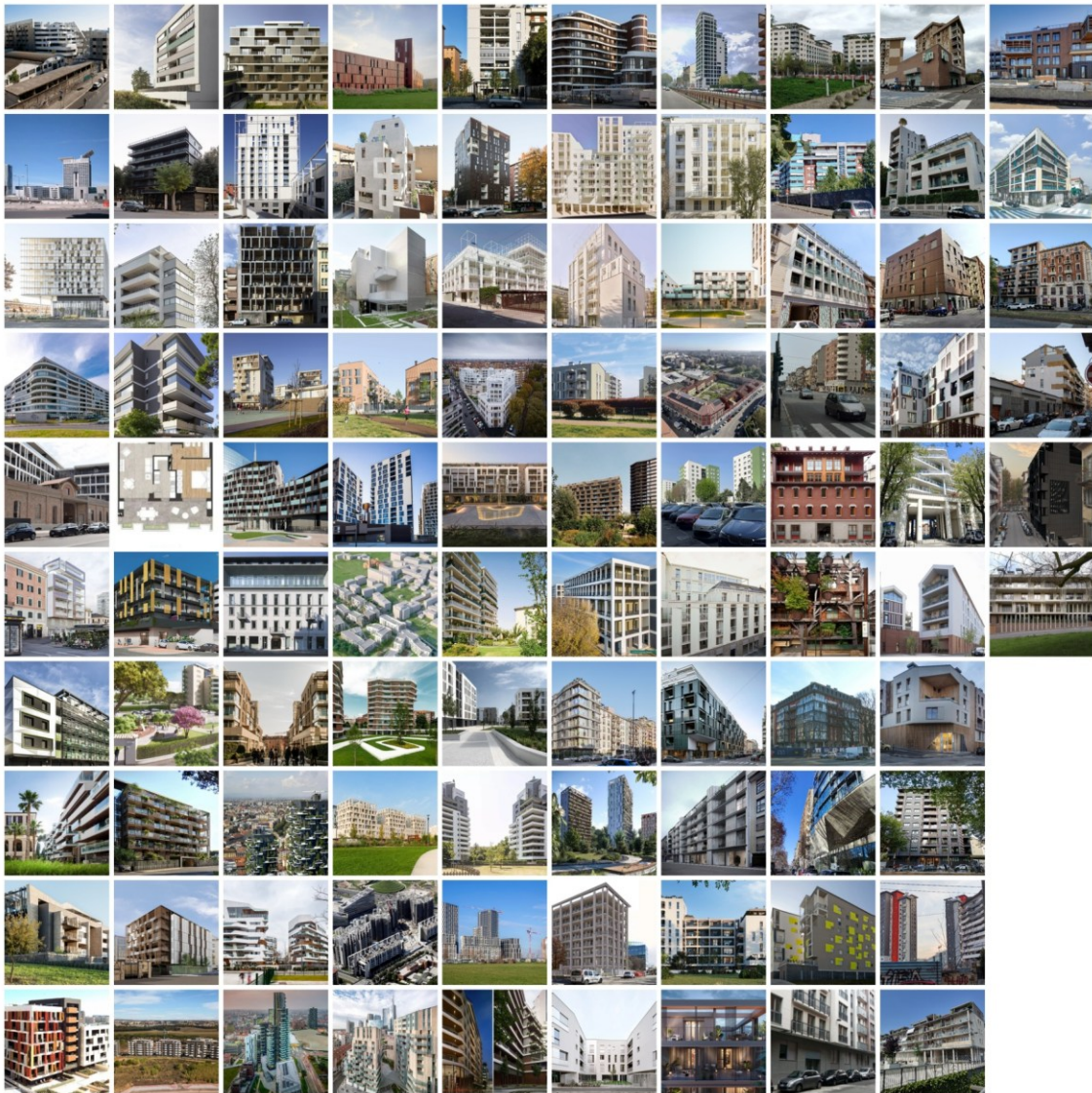


Figure 1.3 Selected new residential projects in Italy since 2010 (Source: Self-drawn)

Tracing the development of China's 'fourth-generation housing', the 'Vertical Forest' residential project completed in Milan, Italy, in 2014 serves as a key reference for

relevant practices in China^[11]. Through the use of vertical greening on balconies, this project harmonises the relationship between humans and nature, showcasing the innovative thinking behind balcony design in recent Italian residential architecture and exerting a significant influence on subsequent residential development. Mirroring trends in China, balconies in Italian apartment blocks are also becoming increasingly multifunctional. Apartment projects featuring balconies with deep projections and wide spans are emerging in increasing numbers, and the value of the balcony as a private outdoor space is becoming increasingly apparent. Particularly in the wake of the COVID-19 pandemic, the pursuit of outdoor space within the home has become a major trend in Italian residential construction^[12]. During my exchange programme at the Polytechnic University of Turin, I conducted field research on numerous residential projects. The distinctive balcony spaces observed there have catalysed a comprehensive transformation in the design of floor plans and elevations, reflecting a shift in residential philosophy towards a greater emphasis on quality of life and a yearning for a pastoral lifestyle.

1.1.5 The Italian experience offers valuable insights for the construction of high-quality housing in China

Against this backdrop, although there are certain differences between China and Italy in terms of geography, climate, stage of development and housing culture, the evolution of balcony design in Italian apartment blocks in recent years can still provide a useful reference for the current construction of high-quality housing in China. From a design perspective, lessons can be drawn from their experience regarding balcony area ratios, spatial dimensions, functional layout and interface design; from a management and maintenance perspective, their models of resident co-governance and long-term management can be adopted to improve the unified maintenance mechanisms for vertical greening. Consequently, examining the development trends of Italian multi-unit housing from the perspective of balconies offers valuable insights for China in enhancing residential design standards and operational management levels, and in promoting the construction of high-quality housing.

1.2 Definition of Concepts and Scope of Research

1.2.1 The Multiple Roles of Multi-unit Housing

Multi-unit housing refers to a building containing multiple residential units designed to accommodate several households ^[13]. Against the backdrop of China's high-density urbanisation, multi-unit housing is not only the primary form of residence for urban dwellers but also embodies multiple roles and meanings across various dimensions.

At the **household** level, collective housing possesses individuality. The residential unit serves as the physical vessel for an independent household, with partition walls and floor slabs delineating a private domain protected by law. Once the door is closed, the internal three-dimensional space becomes an exclusive private domain, within which residents may autonomously arrange and continuously adapt their living environment according to their own lifestyle habits, functional requirements and aesthetic preferences. From this perspective, the balcony, as the interface through which the dwelling presents itself to the outside world, is not only a physical extension of the interior space but also a vital tool for residents to express themselves to the external environment, regulate the balance between openness and enclosure, and implement personalised climate control.

At the **neighbourhood** level, collective housing is characterised by a sense of harmony. Unlike detached houses, the functioning of collective housing relies on shared infrastructure such as lifts, corridors and communal spaces within the residential complex. Individual spatial rights are constrained by a public contract, and spatial interventions must not infringe upon the normal exercise of rights by residents of adjacent units. Consequently, the treatment of the residential façade must seek self-expression whilst respecting the harmonious order of the neighbourhood. As a key component of the building façade, the balcony serves as a sensitive interface where residents' views intersect; it is the primary spatial medium for balancing individual aspirations with neighbourhood harmony.

At the **urban** level, collective housing exhibits a sense of wholeness. Residential units form blocks, which in turn form clusters, residential estates and neighbourhoods, ultimately shaping the urban fabric, spatial order and visual identity. From an urban design perspective, the building's massing, façade and balconies must respond to the specific spatial relationships of the site; the coherence of the urban landscape depends on the holistic management of the facades of collective housing. Consequently, the design, intervention and management of balconies are not merely individual acts or the result of self-organised negotiations among residents, but must be subject to the joint constraints

of public aesthetics and institutional planning within the overall urban order.

1.2.2 Redefining the Balcony

The *Encyclopaedia of China* defines a ‘balcony’ as ‘an outdoor platform on the upper storey of a building, enclosed by railings or balustrades’, explaining that balconies can be classified as open or enclosed depending on whether external windows are fitted, and as recessed, projecting or semi-recessed/semi-projecting depending on their relationship to the main wall; in contrast to a ‘terrace’, a balcony has a permanent roof. [14] China’s Code for Design of Residential Buildings (GB50096-2011) adopts this definition, defining a balcony as “a space attached to the external wall of a building, equipped with railings or balustrades, and suitable for human activity” [15]. It is thus evident that, in the Chinese linguistic context, the term “balcony” actually encompasses a wide range of spatial types.

The above definitions describe the morphological characteristics of balconies and distinguish between various types, but they fail to adequately capture the essence of balcony space. This paper defines a ‘balcony’ as **‘a private outdoor space within a household of flats’**. In this concept, ‘block of flats’ delimits the scope of the study; ‘outdoor space’ emphasises its direct connection with the outdoor air, sunlight, wind and rain, climate, and urban natural scenery, and, as a ‘transitional space’ bridging the indoors and outdoors, it can accommodate a rich variety of living scenarios; ‘private’ emphasises the exclusivity of ownership and usage rights, serving a single household only. This concept does not presuppose any specific morphological characteristics and can therefore encompass ‘balcony’ spaces of all forms, including those that are recessed or protruding, enclosed or open.

Though small in size, the balcony is of great significance. Internally, it fulfils diverse functions within the home—such as airing laundry, storage, viewing the scenery, leisure, entertaining guests and exercise—embodying the individuality of collective housing. Externally, it directly shapes the rhythm of the façade, the depth of shadows and its recognisability, influencing the overall image, whilst also impacting issues such as structural cantilevers, waterproofing and drainage, climate control and façade maintenance, reflecting the harmony and integrity of collective housing. Consequently, the balcony embodies the ingenuity and standard of residential design, influencing the city’s overall character; its significance and value must therefore be recognised. **Research**

into the balconies of apartment blocks can be approached from two perspectives: the internal residential perspective and the external urban perspective.

1.2.3 Description of the Spatial and Temporal Scope of the Study

The scope of this study is limited to urban collective housing projects—including new builds, renovations and reconstructions—within the municipal boundaries of Rome, Milan and Turin in Italy since 2010, excluding detached houses and rural dwellings. In terms of housing type, the study covers standard commercial housing, social housing and mixed-use housing. The research takes the specific element of the balcony as its point of entry to examine trends in the overall floor plan layout and façade design of collective housing.

In terms of timing, following the 2008 financial crisis, residential construction in Italy experienced a rapid decline. In particular, from 2010 to the present, total construction volumes have remained at persistently low levels^①, whilst statistical methodologies for relevant data have undergone changes compared to the period prior to 2010. In 2014, landmark projects such as Milan's 'Vertical Forest' and Turin's 'Giardino 25' were successively completed. Consequently, taking into account the overall trend of these changes, the convenience of research, and the timing of the emergence of typical case studies, this paper takes 2010 as the starting point for observing contemporary trends in Italian residential construction and design.

Geographically speaking, Rome (Roma Capitale) is the capital of Italy, covering an area of 1,286.72 km² with a population of 2.747 million (2025). Milan (Commune di Milano) is a major economic centre in Italy, covering an area of 181.64 km² with a population of 1.356 million (2025); the 2015 Milan Expo and the 2026 Milan-Cortina Winter Olympics have enhanced Milan's global profile. Turin (Città di Torino) is renowned for its automotive industry, covering an area of 130.11 km² with a population of 853,000 (2025)^②. In terms of gross domestic product, Milan, Rome and Turin rank as Italy's top three cities.^③ In terms of population, Rome, Milan and Turin are respectively

① Delmendo L C. Italy's residential property market analysis 2025[EB/OL]. [2026-03-15]. <https://www.globalpropertyguide.com/europe/italy/price-history>.

② Area and population data from <https://www.tuttitalia.it/lazio/33-roma/>, <https://www.tuttitalia.it/lombardia/18-milano/>, <https://www.tuttitalia.it/piemonte/72-torino/>

③ According to ISTAT, Milan's GDP in 2023 was €230.7 billion, Rome's was €201.2 billion, and Turin's was €86 billion, making them the top three cities in Italy by GDP. Data source: https://esploradati.istat.it/databrowser/#/it/dw/categories/IT1,DATAWAREHOUSE,1.0/UP_ACC_TERRIT

the first, second and fourth largest cities in Italy.^①

In terms of climate, Italy generally enjoys a mild climate. Rome, located in central Italy, has a Mediterranean climate, with hot, dry summers and mild, rainy winters, and plenty of sunshine; Milan and Turin, situated in northern Italy, have a humid subtropical climate, with sweltering summers and cold, damp winters. These three cities share similar climatic characteristics with certain regions of China.

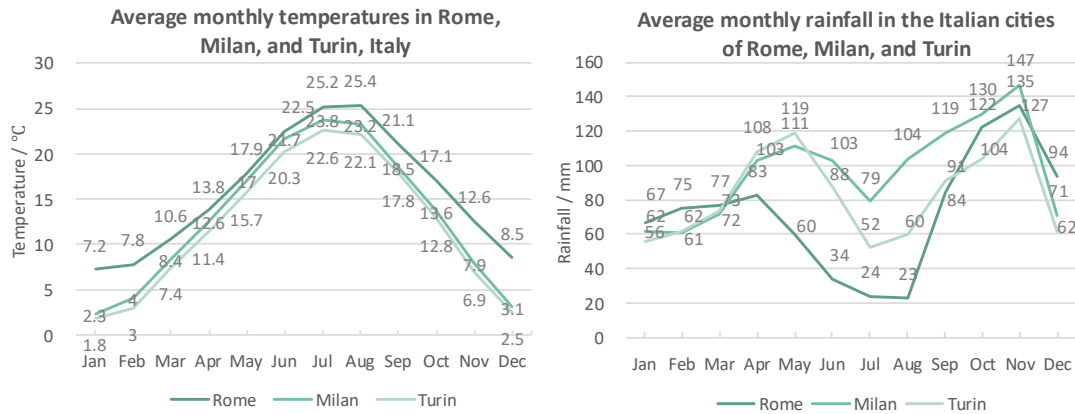


Figure 1.4 Climate data for Rome, Milan, and Turin (Source: <https://en.climate-data.org/>)

A comprehensive study of residential development in Rome, Milan and Turin allows for a consideration of both the overall picture and specific examples, whilst also capturing diversity. Residential construction in these three cities remains relatively active, with a wide variety of housing projects on offer; there is a balance between new-build and regeneration schemes, and many outstanding examples place particular emphasis on the design of residential balconies. By focusing on projects from the past fifteen years, one can identify the distinctive features and trends in residential design during a period of low growth, whilst achieving a balance between the breadth and depth of the projects.

1.3 Literature Review

A literature review of the current state of research both domestically and internationally, focusing on three topics: ‘The History of Modern Italian Housing’, ‘Trends in Italian Housing’, and ‘Residential Balconies’.

1.3.1 Research on the History of Modern Italian Housing

(1) International Research

^① Naples ranks third with a population of 981,000, closely matched by Turin. (Source: <https://www.statista.com/statistics/589331/largest-cities-in-italy-by-population/>)

Trends in Italian Housing There is a wealth of research in international academic circles on the history of modern housing developments in Italy, with a particular focus on post-war social housing and middle-class housing construction. The first area of study concerns post-war social housing. Following the Second World War, housing shortages, population growth and rapid urbanisation combined to trigger a boom in housing construction, and the ‘INA-Casa Plan’ (Piano INA-Casa), implemented between 1949 and 1963, facilitated the large-scale construction of social housing. In *History of Italian Architecture, 1944–1985* ^[16] architectural historian Manfredo Tafuri discusses post-war housing construction within the broader framework of the history of Italian architecture, emphasising its connection to post-war political, economic and architectural developments. Since then, research in this field has continued to deepen, primarily focusing on case studies and historical analyses: Guccione ^[17] focused on the INA-Casa estates in Rome; Zeier Pilat ^[18] noted that this programme not only profoundly influenced the post-war urban spatial layout but also reshaped workers’ housing, family life and neighbourhood relations; Menegatti ^[19] explored the evolution of collective living models in Italian social housing; Escudero ^[20] interprets post-war housing design from an aesthetic and conceptual perspective; whilst Stenti ^[21] systematically traces the historical evolution of Italian social housing between 1903 and 2015.

Secondly, research into post-war middle-class housing has gradually gained prominence over the past decade or so. Compared to social housing, this large body of middle-class apartment housing—developed by property developers, cooperatives or local professional bodies—has long remained on the margins of research into Italy’s post-war housing history. Now that many Italian cities are entering an era of existing stock renewal, studying these housing projects can help provide new case studies for reference. De Pieri et al. ^[22] and Caramellino et al. ^[23], drawing on a vast body of housing case studies from the period 1945–1975 in cities such as Milan, Turin and Rome, and combining archival research with residents’ oral histories, have highlighted the crucial significance of these seemingly ordinary apartment blocks in shaping post-war urban life in Italy. Mosayebi ^[24] and Caruso et al. ^[25] focused respectively on the residential practices of Luigi Caccia Dominioni and Asnago Vender, revealing their crucial role in the formation of Milan’s modern urban form. Building on the aforementioned research, Pierini et al. ^[26] compiled a collection of 80 case studies, showcasing the outstanding achievements of Milan’s golden age of residential architecture from 1923 to 1973, and

tracing its leading figures, representative examples and developmental changes.

(2) Domestic Research

Domestic research on modern Italian housing estates has primarily focused on case studies and architectural historical interpretations, emphasising their significance as a reference for residential design in China. Yang Yunzhao^[27] and Shen Jiacheng^[28] have respectively examined class expression in Italian Rationalist social housing and specific examples of housing design. Building on relevant international research, Xiao Xiao^[29] employed a typological approach to analyse the façade design methods of post-war middle-class block housing in Turin. Pan Yue^[30] has examined how Italian architects' research into traditional vernacular dwellings provided prototypical references for the 20th-century Rationalist movement.

1.3.2 Trends in Italian Housing

(1) International Research

Since the beginning of the 21st century, research on European housing estates, including those in Italy, has focused primarily on topics such as new models of housing estates^[31], spatial flexibility^[32] and changes in lifestyle^[33]. Research into trends in Italian social housing has centred on housing policy and case studies. Caruso^[34] traces the evolution of Italy's social housing system and policies; the OECD^[35] summarises recent developments in Italian housing policy from an international comparative perspective, emphasising the promotion of social integration, affordability and environmental sustainability. Meanwhile, Milan's 'Vertical Forest' (Bosco Verticale)^[36] 'City Life'^[37], 'Via Cenni Social Housing'^[38] and Turin's 'SiTI social housing'^[39] have attracted attention for their innovative practices in ecological design, technological application and social integration.

(2) Domestic Research

Domestic research into recent residential development trends in Europe has generally focused on trend analysis^{[40][41][42]} and the translation and introduction of case studies, with particular attention paid to residential developments in German-speaking regions^{[43][44]}. By comparison, systematic research in China on recent residential development trends in Italy is relatively limited, with a focus on case studies: Luo Yide^[45] compiled examples of social housing design in Italy from 1998 to 2013, summarising explorations in both urban integration and innovations in quality enhancement; Liu

Yijia^[46] introduced methods for the industrialised renovation of social housing in Milan; Xu Yibo et al. ^[11] analysed the ecological concepts and technical characteristics of the ‘Vertical Forest’ project. Meanwhile, several representative Italian housing projects, such as the Residence Carlo Erba ^[47] , have also been featured in the press. As domestic housing construction has entered a phase of stock renewal, research perspectives have gradually extended to the level of policy and renewal mechanisms: Bai Xueying^[48] studied the renewal policies for social housing in Italy, whilst Su Cheng^[49] summarised the models and characteristics of community renewal in Italy.

1.3.3 Residential Balconies

(1) International Research

As a common architectural element, the balcony in apartment blocks has long been a subject of architectural research. In his book *A Pattern Language* ^[50] , Alexander Christopher proposed empirical guidelines regarding the appropriate depth and degree of enclosure for balconies, whilst Rem Koolhaas, in *Elements of Architecture* ^[51] , systematically traced the historical origins and evolutionary process of the balcony, presenting a panorama of its development.

In the wake of the COVID-19 pandemic, academic interest in apartment block balconies has gradually increased^{[52][53][54]} , with balconies being viewed as threshold or in-between spaces mediating the transition between interior and exterior, and public and private spheres. Canepa^[55] and Bassetti^[56] employed interview and observation methods to study neighbourhood interactions on residential balconies in Italy during the pandemic. Solak et al.^[57] utilised statistical methods to verify the positive benefits of balconies on residents’ physical and mental health during the pandemic. Ribeiro et al.^[58] , meanwhile, began by examining the evolution of the functions and focal points of residential balconies since the 19th century, defining them as spatial prototypes that promote health and well-being.

(2) Domestic Research

Domestic research on balconies in multi-unit housing is relatively extensive, primarily focusing on historical perspectives, user experience and climate adaptability. Huang Xiangqiu. ^[59] explored the etymology and spatial prototype of the balcony, tracing the historical evolution of balconies in Chinese multi-unit housing since 1840. Wang Chen ^[60] conducted a survey and analysis of the current usage of balconies by households

of different age groups in apartment blocks from various eras, paying particular attention to the calculation of balcony area, regulations regarding enclosure and openness, and their impact on actual housing functionality and comfort. Zhang Chao^[61] and Hao Ling^[62] discussed the regionally adapted design of apartment block balconies, using residential buildings in northern Jiangsu and cold regions as examples, respectively.

In recent years, with the renewed emphasis on residential health triggered by the pandemic, the domestic academic community has begun to re-examine the significance of balconies in contemporary housing. Zhang Lufeng^[4] reviewed relevant research on balconies, collating and summarising recent innovative design cases in residential buildings. Song Chenguang^[63] focused on balconies in Beijing's apartment blocks, analysing their development and evolution from the perspectives of policy, development and construction, design approaches, and resident usage. Xie Lianchun^[64] has, in turn, examined the impact of balconies on the overall urban landscape. Dai Xuan'ang et al.^[65] have introduced multivariate statistical analysis methods to extract and code characteristics such as the extent and types of greenery in 'sky courtyards', thereby summarising the typology of China's 'fourth-generation housing'.

1.3.4 Review of the Current State of Research

In summary, research conducted both domestically and internationally on the history of modern Italian collective housing, trends in collective housing development, and residential balconies has been carried out across multiple dimensions, including case studies, historical analysis, key figures and housing policies, providing a vital foundation for understanding the evolution of Italian collective housing and balconies. However, overall, existing research on Italian collective housing balconies still suffers from two main shortcomings.

Firstly, in terms of research content, existing studies have primarily focused on case studies, lacking a systematic examination that integrates residential usage requirements with the design characteristics of balconies. In particular, there remains a dearth of research on the overall changes in balcony design in Italian collective housing since 2010, as well as the transformation in residential philosophies reflected therein.

Secondly, in terms of research methodology, existing studies have primarily relied on literature reviews, case studies, typological analysis and interviews, whilst large-scale, data-driven quantitative analyses remain limited, resulting in an insufficient exploration

of overarching characteristics.

Consequently, this paper takes recent Italian apartment blocks as its subject, focusing on balcony design. Employing methods such as sampling, typological analysis and statistical analysis, it distils the characteristics of balcony design from a combined qualitative and quantitative perspective. Furthermore, by integrating literature reviews on relevant policies, regulations and operational management measures, it provides an in-depth analysis of the underlying shifts in residential philosophy, responses to climate change, urban regeneration governance, thereby addressing the shortcomings of existing research and aiming to provide valuable reference and insights for the future development of housing in China.

1.4 Research Objectives and Significance

1.4.1 Analysing the Characteristics of Italian Residential Balconies Using a Methodology Combining Data and Case Studies

Based on field research and online data collection, this study has compiled a case study collection of recent Italian residential housing projects. By comprehensively applying statistical analysis and typological induction methods, it systematically examines the balcony designs in representative Italian residential housing projects since 2010, identifying the main typologies and evolutionary characteristics in terms of floor plan dimensions, façade configurations, functional layouts and detailed design. By combining the specificity of case studies with the scientific rigour and systematic nature of data analysis, this paper aims to reveal the overall characteristics of Italian residential balconies more objectively, based on a large sample size.

1.4.2 Exploring the Evolution of Italian Residential Philosophy and Housing Development Trends from a Micro-level Perspective of Balcony Design

Internally, balconies influence the daily use of a dwelling; externally, they affect the overall image of the building. The functional configuration of balconies reflects changes in residents' multifaceted needs regarding nature, social interaction and leisure; the plan dimensions and size of balconies influence the spatial connectivity of the overall floor plan and the organisation of daily circulation; whilst the façade composition and surface

treatment of balconies contribute to the building's form and the shaping of its overall image. Therefore, by approaching the subject from the micro-perspective of balcony design—seeing the big picture through the small details—one can meticulously reveal the residential philosophies and development trends of recent Italian apartment blocks.

1.4.3 Providing Reference for the Development of High-Quality Housing in China by Drawing on Italian Balcony Design Experience

Against the backdrop of China's housing sector shifting from scale expansion to high-quality development, balcony design holds significant importance for enhancing living standards and urban aesthetics. Recent Italian apartment blocks have not only undertaken extensive exploration in terms of balcony typology, function and detailing, but have also accumulated mature experience in areas such as the long-term maintenance of residential façades. Furthermore, the application of vertical greening technology on balconies in Italian multi-unit housing began at an early stage, and their experience in plant selection, the allocation of maintenance responsibilities and operational management is also of reference value. By drawing on the design experience of Italian multi-unit housing balconies, targeted insights and references can be provided for innovation in China's residential design, the enhancement of living quality and the optimisation of management mechanisms, thereby achieving a harmonious balance between living spaces and the diverse needs of residents, and promoting the high-quality development of multi-unit housing in China.

1.5 Research Methods

1.5.1 Literature Review Method

This involves reviewing relevant regulations, standards and policy documents in the Italian housing sector to clarify the institutional context and constraints governing housing construction. A systematic review of research findings on Italian apartment blocks and residential balconies will be conducted to summarise the development history of Italian apartment blocks, representative case studies and the characteristics of each phase. This will enable recent housing projects since 2010 to be situated within a historical framework, thereby further clarifying their positioning, characteristics and key research focus.

1.5.2 Case Study Method

A purposive sampling approach was adopted, utilising architectural journals, publicly available online resources and architectural award selections as primary sources of information. This was combined with field visits to verify and supplement the data, thereby constructing a case study collection. On this basis, representative cases were examined, focusing on elements such as balcony design features, floor plan organisation and façade composition methods, to distil representative spatial strategies and design principles.

1.5.3 Survey and Interview Method

In conjunction with site visits, interviews were conducted with residents and architects to gain a deeper understanding of design guidelines for balcony spaces, municipal regulations, actual usage scenarios, year-round comfort, and long-term maintenance issues. The information obtained from these interviews was used to verify and supplement the textual case study data, thereby enhancing the completeness and reliability of the research material.

1.5.4 Typological Induction Method

Technical drawings of the case studies were redrawn to distil the morphological characteristics and configuration patterns of balconies, whilst identifying features relating to usage scenarios, interface treatments and design strategies. Based on comparative analysis of the case studies, balcony typologies were further summarised and categorised.

1.5.5 Statistical Analysis Method

Building upon the typological analysis, quantitative statistical analysis of project and balcony-related indicators was introduced. Project types, site conditions, and construction methods were coded based on the basic case information, whilst key data—such as unit floor area, number of rooms, balcony plan dimensions, balcony area ratios, and balcony functions—were extracted from the redrawn drawings. By organising and analysing these coded indicators and data, precise data support was provided for subsequent analysis, aiding in the identification of overall characteristics.

1.6 Research Framework

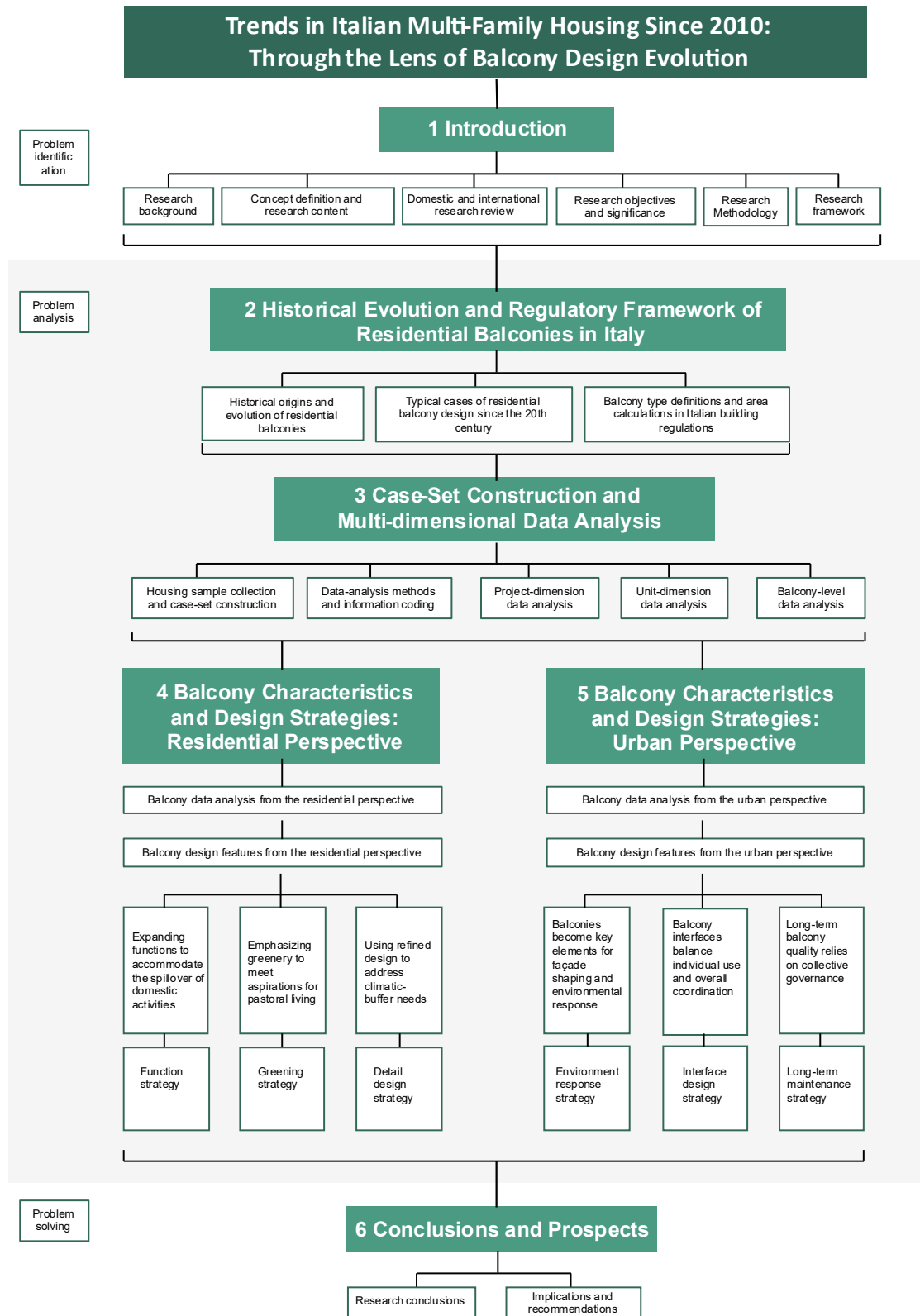


Figure 1.5 Research Framework (Source: Self-drawn)

Chapter 2 Historical Evolution and Regulatory Framework of Residential Balconies in Italy

Italian apartment blocks have a long history, dating back to the Roman era. As an integral part of these buildings, balconies have evolved in tandem with changes in urban form, construction techniques and living patterns, gradually giving rise to a distinctive Italian lifestyle centred around balconies, as well as detailed classification and management policies. This chapter traces the development of residential balconies against the backdrop of the evolution of Italian multi-unit housing, examining typical examples from different historical periods. It further analyses contemporary policy regulations governing residential balconies, clarifying their classification methods and area calculation techniques, thereby providing a historical reference and policy context for subsequent research into recent design characteristics of residential balconies.

2.1 The Historical Origins and Evolution of Residential Balconies

2.1.1 The Emergence of the Prototype Balcony in Ancient Rome

Italian collective housing can be traced back to the architectural prototype of the *insula* (block of flats) from the Roman period.^① The early prototype of the balcony can be traced to the wooden cantilevered structures (*maenianum*) of the spectator stands in the amphitheatre.^② This technique was gradually integrated into the facades of residential



Figure 2.1 The prototype of a balcony in ancient Rome (Source: www.billdonohoe.com)

① Treccani. *Insula*[EB/OL]. [2026-03-15]. https://www.treccani.it/enciclopedia/insula_%28Enciclopedia-dell%27-Arte-Antica%29/.

② Parco archeologico del Colosseo. *La Cavea del Colosseo e la Terrazza del Belvedere*[EB/OL]. [2026-03-15]. <https://colosseo.it/mirabilia/la-cavea-del-colosseo-e-la-terrazza-del-belvedere/>

buildings and applied to the insulae in the crowded urban environments of ancient Rome, providing residents with their own ‘private outdoor space’.

2.1.2 The Establishment of Renaissance Balcony Forms



Figure 2.3 Palazzo Farnese in Rome (left) and Palazzo Medici Riccardi in Florence (right)
(Source: <https://visite-palazzofarnese.it/>, <https://www.palazzomediciriccardi.it/il-palazzo/>)



Figure 2.2 Palazzo Davanzati, Florence (left); Ca d'Oro, Venice (top right); Palazzo Piccolomini, Pienza (bottom right) (Source: <https://apollo-magazine.com/>, <https://www.palazzopiccolominipienza.it/>)

With the advent of the Renaissance, the aristocratic residence (palazzo) in Italian cities emerged as a distinctive architectural type that combined residential functions with ceremonial purposes. Such residences served not only as the family’s daily dwelling but also as a venue for displaying their power, wealth and ceremonial order.

In such residences, projecting stone or brick balconies (balcone) were regarded as key compositional elements of the façade. Typically situated at the centre of the piano nobile (the first floor above ground level), they connected with principal rooms or ceremonial spaces, reinforcing the sense of centrality and order within the façade’s composition. On the one hand, the projecting balcony provided a vantage point from which to view the street from above; on the other, it allowed the inhabitants to be seen by

others without leaving the building, thereby participating in ceremonial interactions and urban life, and consequently granting the private residence greater visibility and symbolic significance within the public sphere.^[66]

In contrast to projecting balconies, loggias are typically set back from the façade, forming an open interface through colonnades or arches. This allows the space to provide shelter from sun and rain whilst maintaining ventilation and visual permeability, making it more akin to a ‘semi-outdoor room’ suitable for prolonged occupation. In many of Florence’s aristocratic mansions, the main façade is relatively enclosed to enhance security and privacy, whilst loggias are often situated on the top floor to provide better lighting, ventilation and views, creating a distinctive architectural vocabulary. In contrast, the façades of aristocratic residences in Venice are relatively more open, featuring flamboyant windows—a blend of Gothic and Byzantine architectural styles—as the external interface of the loggia balconies. This results in a richly expressive façade with distinctive play of light and shadow.

2.1.3 Technological Innovations in Balconies during the Industrial Era



Figure 2.4 Rome's Via Nazionale (left); a street-facing balcony in Milan's Canal District (middle); a balcony in Turin facing a courtyard (right). Sources: <https://commons.wikimedia.org/>, <https://st.hzcdn.com/>, <https://www.apartmenttherapy.com/>

In the 19th century, as industrialisation and urbanisation progressed, European cities generally experienced rapid population growth and urban expansion. Following the unification of Italy, cities such as Rome and Milan successively launched the construction of apartment blocks to accommodate urban expansion. Taking the multi-storey apartment blocks along Via Nazionale in Rome as an example, the façades of these buildings largely drew upon the classical vocabulary of aristocratic mansions, featuring ceremonial balconies positioned centrally on the main storey to serve symbolic and display functions. With the development of metalworking techniques, wrought-iron balustrades for balconies gradually became widespread. The originally heavy, solid surfaces of the

balconies transformed into light and airy features; combined with potted flowers placed on them, they became a delightful adornment to the urban streetscape. As modern concepts of public health and healthy living gradually emerged, the value of balconies in terms of lighting, sunlight and ventilation for the living environment began to be recognised. The inclusion of balconies in residential buildings has become increasingly widespread, evolving from a ceremonial expression on the façade to an indispensable component of modern living spaces.

Urban districts formed during this period often adopted a block layout, with buildings frequently sharing walls on two sides; consequently, building façades could be divided into the front façade facing the city street and the rear façade facing the inner courtyard of the block. Balconies on the front façade are often meticulously designed to serve a ceremonial function in shaping the building's external image, whilst those on the rear façade are relatively more informal, serving daily activities such as drying laundry and leisure. This distinction between the internal and external attributes of these façades and balconies continues to influence current usage habits and management regulations in Italian urban housing.

In densely populated areas, to maximise the use of the street-facing façade, a residential typology known as the 'ballatoio' has gradually evolved, featuring semi-outdoor corridors in the inner courtyard that connect individual dwellings. Here, the ballatoio is not privately owned but rather a semi-private transitional space jointly owned and used by the neighbourhood; whilst it is related to the 'private outdoor space' discussed in this article, it is not identical to it.

2.2 Typical Examples of Residential Balcony Design since the 20th Century

2.2.1 Exploration of Balcony Façade Forms during the Rationalist Period

As reinforced concrete structural systems gradually matured, cantilevered slabs became increasingly common in block housing, meaning that balconies no longer had to rely on heavy masonry or stone beams for support. At the same time, further developments in metalworking and glass balustrade technology made the balcony's interface lighter and more transparent. These dual advancements in structure and materials not only expanded the possibilities for balcony depth and scale but also significantly enhanced the freedom of their façade composition.

In the exploration of Rationalist architecture in Italy during the first half of the twentieth century, architects utilised the interplay of protrusions and recesses on the façade, along with the layers of shadow created by balconies, to organise contrasts between solid and void and to establish compositional relationships between horizontal and vertical elements. Through this, they sought to enhance the depth and rhythm of the façade and to explore a modern architectural vocabulary.

Giuseppe Terragni's Novocomum apartment block (Como, 1927–1929) is often regarded as one of the defining examples of early Italian Rationalist housing. Its façade employs curved corners and projecting surfaces to create a striking volumetric expression. Here, the balconies serve a compositional function by facilitating the transition of volumes, extending the building horizontally and creating layers, thus becoming a vital component of the façade's architectural language. Through the continuous horizontal lines of the balcony slabs and the sense of openness provided by the balustrades, the



Figure 2.5 Novocomum, Como (left); Casa Rustici, Milan (right) (Source: <https://architectuul.com/>, <https://www.domusweb.it/>)

building's horizontal character and the dynamic of the corners are further emphasised, endowing the façade with greater depth and rhythm.

In Milan, the balcony in Casa Rustici (1933–1935), a collaboration between Terragni and Pietro Lingeri, serves as a compositional device akin to a 'suspended bridge', establishing a connection between two solid volumes and lending the main façade a strong sense of unity and transparency.

Similarly, in Casa Lavezzari (1934), another collaboration between the two architects, the control of the solid and void elements of the balustrade, the spatial relationship between the balcony and the main building, and the depth of the recess creates a clearer 'foreground–background' hierarchy between the balcony and the main volume, fully exploring the potential of the balcony in shaping the composition of solid and void elements.



Figure 2.6 Casa Lavezzari, Milan (Source: <https://www.lombardiabeniculturali.it/>)

In stark contrast to this is the project by Asnago Vender at Viale Tunisia, 50 (1935). In this building, the balconies are treated as the primary elements of the façade, with their depth and width varying in response to the changing storeys.

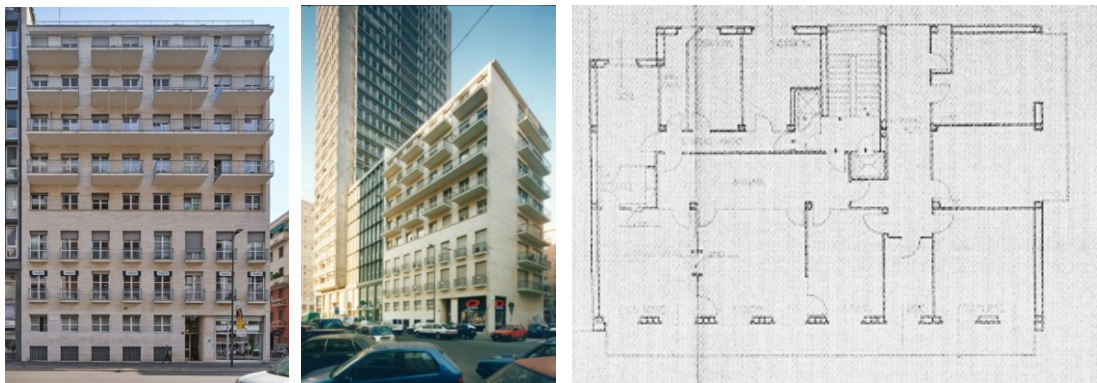


Figure 2.7 Viale Tunisia, Milan (Source: <https://www.lombardiabeniculturali.it/>)

2.2.2 Diverse Innovations in Balcony Design During the Post-War Housing Boom

Following the end of the Second World War, many Italian cities lay in ruins after suffering air raids and faced a severe housing shortage. To address this issue, housing construction entered an unprecedented boom period. On the one hand, the multiple phases of the INA-Casa Plan (Piano INA-Casa) carried out between 1949 and 1963 promoted the large-scale construction of social housing on the outskirts of cities. On the other hand, in cities such as Milan, many architects continued the pre-war rationalist explorations in the field of housing construction, focusing on building typologies and urban form, and creating representative examples of Italian modernist housing.

The social housing built under the INA-Casa programme is found throughout Italian cities, combining rich local vernacular characteristics with a homogeneous aesthetic that reflects a commitment to equality. Within a single residential block, the facades—including the balconies—are relatively consistent across different storeys, aligned vertically and maintained at a fixed scale; yet within the same neighbourhood, different blocks vary in their floor plans, number of storeys, typology and appearance, thereby embodying a sense of distinctiveness.

Taking the Tuscolano II housing project in Rome (1952–1957) as an example, the development employs a combination of tower blocks and slab blocks to create a rich texture, whilst the use of large-scale, continuous slab blocks serves to define the estate's character. The tower blocks feature generously proportioned balconies: projecting balconies adjoin the bedrooms, whilst semi-recessed and semi-projecting balconies connect to the living rooms, serving as an extension of the interior space. In contrast, the slab blocks have smaller projecting balconies, with metal railings painted the same colour



Figure 2.8 The Tuscolano II residential area in Rome (Source: <https://archidiap.com/opera/quartiere-tuscolano-ii/>)

as the sunshade louvers; within the dwellings, both side elevations feature balconies, which may connect either to the living room or the bedroom. Residents enjoy placing potted plants on the balcony floors or hanging flowers and greenery from the railings, adding vitality to the vertically aligned balconies and uniform facades.

The Gallarate social housing complex in Milan (1967–1973), designed by Aldo Rossi in collaboration with Carlo Aymonino, is another exemplary example of post-war social housing in Italy. In this linear, homogeneous development, balconies and windows

are integrated into a rigorous façade grid, making it almost impossible to distinguish between them when viewed from the outside.



Figure 2.10 Gallarate social housing in Milan (Source: <https://www.archiposition.com/items/b972fe5f03>)

During the post-war boom in housing construction, alongside the public housing system, the development of private housing in major cities such as Milan provided practical opportunities for the development of architectural culture and the exploration of materials and space. Architects such as Ignazio Gardella, Luigi Moretti and Luigi Caccia Dominioni.



Figure 2.9 Milan Casa al Parco (Casa Tognella) (above); Venice Casa alle Zattere (below)
Sources: <https://censimentoarchitettturecontemporanee.cultura.gov.it/>,
<https://archidiap.com/opera/casa-alle-zattere/>

The ‘Casa al Parco’ (1947–1954), designed by Ignazio Gardella, is a prime example of post-war social housing in Milan. Situated adjacent to Parco Sempione, the building comprises two staggered rectangular volumes. The side facing the park features an open-plan living area constructed with a frame structure; large, open balconies emphasise horizontality, whilst the recessed loggia on the top floor draws on historical precedents. The opposite side houses the bedroom area, built with load-bearing walls and characterised by recessed balconies that create vertical lines.

His Casa alle Zattere (1958–1962) in Venice, meanwhile, engages in a dialogue with the surrounding architecture and urban culture within the historic city context through the use of balconies and façade language. The building’s façade follows the contours of the waterfront, and its composition echoes the traditional vocabulary of Venetian noble residences, exemplified by the Palazzo d’Oro. A substantial, high stone plinth establishes a sense of stability along the waterfront, whilst the rhythm of vertical openings and polifore (multi-light windows) maintains the scale of the urban façade. The asymmetrical arrangement of balconies and balustrades creates a layered, banded structure on the façade. Furthermore, the use of coloured stucco on the façade, combined with white marble for the balcony balustrades and window surrounds, reinforces the building’s sense of place.

Luigi Moretti’s design for Corso Italia 13–17 in Milan is a mixed-use urban regeneration project. The traditional urban fabric of the area was severely damaged by wartime bombing, and the post-war reconstruction provided the architect with the spatial conditions to reorganise the street frontage and the relationship between building volumes. Completed in 1956, the building’s large-scale cantilevered volume facing the street possesses a directionality and dynamism reminiscent of a ship’s bow, creating a strong urban identity. The recessed balconies on the reverse side of this ship-like form enhance the volume’s depth and sculptural quality.

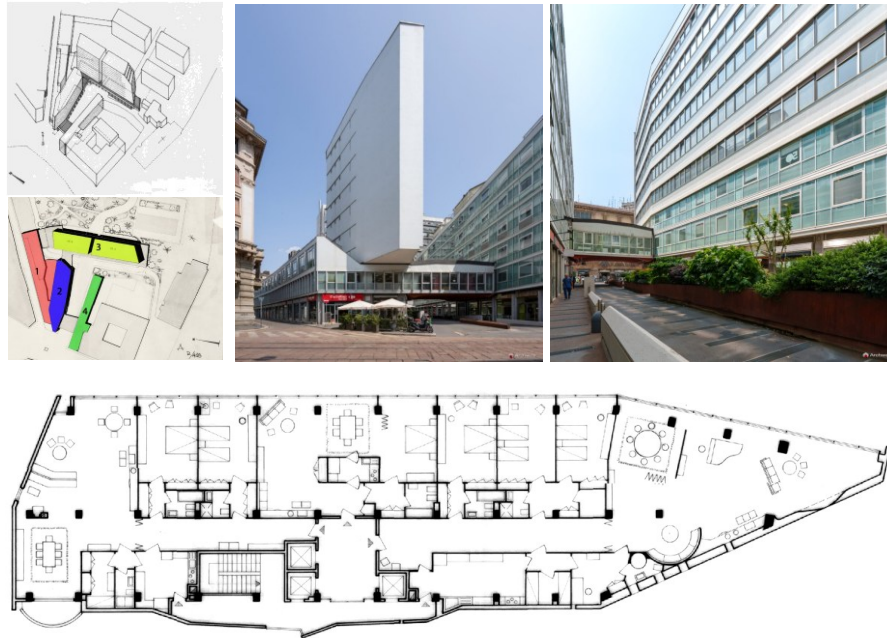


Figure 2.11 Corso Italia, Milan, 13-17 (Source: <https://www.archweb.com/>, <https://architizer.com/projects/corso-italia-13-1/>)

The project at Corso Italia, 22–24 in Milan, completed by Luigi Caccia Dominioni between 1957 and 1964, faces the Church of Sant’Eufemia. On the street-facing side, a bridge-like structure connects the two six-storey towers, creating a symmetrical façade that faces the church. The towers are clad entirely in deep red ceramic tiles; the bridge-like volume features a continuous glass curtain wall, beneath which lies an arched portico. At ground level, shop windows create a continuous street frontage, whilst the portico also serves as the main entrance to the internal garden, providing a spatial transition from the street to the inner courtyard and offering beautiful and varied views of the buildings within the site.

The Piazza Carbonari project, also designed by him, features a highly cohesive, free-form façade composition. The building’s volumes are clearly defined, with a façade clad in ceramic panels and window and door frames set flush with the surface. The positioning of the window openings has been carefully adjusted to accommodate the interior layout and views. This approach served as a source of inspiration for subsequent projects.



Figure 2.12 Corso Italia, 22-24 (Top); Piazza Carbonari (Down) (Source: <https://www.lombardiabeniculturali.it/>, <https://archive.pinupmagazine.org/>)

2.2.3 The Emergence of Balcony Ecology in the Wake of the Energy Crisis

In the 1970s, Europe experienced two successive oil crises, with oil prices fluctuating dramatically over a short period, severely impacting economic production and people's daily lives. As one of the European countries most dependent on foreign energy sources, Italy relied heavily on oil imports and was particularly hard hit. This energy crisis rapidly spread to the construction sector. On the one hand, building operating costs rose sharply, with heating, cooling and lighting expenses becoming a heavy burden for residents and property owners, making energy conservation a pressing economic necessity. On the other hand, architects and engineers began to reflect on the relationship

between the built environment and the natural environment, shifting their focus to new issues such as energy flows, climate responsiveness and resource efficiency, thereby promoting the green and low-carbon transformation of buildings. Residential buildings, being numerous and offering significant potential for energy savings, received particular attention.

At the national level, Italy has been gradually establishing a policy and standards framework to promote the green and low-carbon transition of residential buildings since the 1970s. In 1976, Italy enacted a decree setting thermal energy consumption standards for buildings.^① In 1991, a decree was issued to implement the National Energy Plan, driving the sustainable energy transition and establishing rules for controlling building energy consumption.^② In 2005, in response to the EU's Energy Performance of Buildings Directive (EPBD), a decree was issued introducing building energy performance assessment standards, requiring improved energy efficiency in new buildings and encouraging the enhancement of energy efficiency in existing buildings through renovation.^③ In 2007, to encourage voluntary renovation by building owners aiming to improve the energy performance of existing buildings, tax relief policies for energy-saving retrofits were introduced to enhance economic viability.^④

Balconies, as a means of regulating passive buildings, help to reduce indoor heat gain and promote natural ventilation, offering significant ecological benefits. Located in the mountainous region of north-eastern Italy, the Casa Nova eco-housing estate in Bolzano employs a clustered layout. The relatively solid external facades form the boundaries of the clusters, whilst the interiors face green courtyards; the use of recessed balconies helps foster a sense of community. A combination of passive strategies and building envelope measures, including the balconies, has enabled the development to achieve a Casa Clima Class A energy efficiency rating.

① LEGGE 30 marzo 1976, n. 373[EB/OL]. [2026-03-15]. <https://www.normattiva.it/uri-res/N2Ls?!vig=urn:nir:stato:legge:1976-04-30;373>.

② LEGGE 9 gennaio 1991, n. 10[EB/OL]. [2026-03-15]. <https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:1991-01-09;10!vig=>.

③ DECRETO LEGISLATIVO 19 agosto 2005, n. 192[EB/OL]. [2026-03-15]. <https://www.normattiva.it/uri-res/N2Ls?urn:nir:2005;192>.

④ Agenzia delle Entrate. Riqualficazione energetica – Che cos'è[EB/OL]. [2026-03-15]. <https://www.agenziaentrate.gov.it/portale/schede/agevolazioni/detrazione-riqualificazione-energetica-55-2016/cosa-riqualificazione-55-2016>.



Figure 2.13 Casa Nova eco-community in Bolzano (Source: <https://archello.com/project/casanova-masterplan>, <https://www.archdaily.com/>)

2.2.4 The Evolution of Balconies in the Era of Existing Stock Regeneration

Since the 1990s, the pace of expansion in major Italian cities has slowed, whilst the transition to a post-industrial economy has accelerated; the focus of urban development has gradually shifted towards the regeneration and reuse of the existing built environment. A large number of industrial buildings and sites have been repurposed as new residential neighbourhoods. In this context, balconies play a role in shaping the overall character of the housing.

The ex-Junghans residential complex in Venice (1997–2003), designed by Cino Zucchi, is a typical example of an industrial heritage regeneration project. The project maintains a block-scale approach, translating traditional Venetian urban vocabulary—such as light-coloured stone window surrounds—into the design. Through the detailing of balconies and window openings, it establishes a dialogue between old and new, creating a more graphic treatment of the interface. Furthermore, the placement of window glazing at varying depths reinforces the spatial layering of the façade.

Cino Zucchi's Nuovo Portello housing estate in Milan (2002–2008), developed from the former Alfa Romeo car park, utilises balconies to create a distinctive visual identity between the buildings. The project organises the site along a diagonal axis running from north-west to south-east, linking the new housing estate with the urban space to the south-east. The three slab blocks on the eastern side are social housing, opening out towards the park to the south: their northern and eastern façades are relatively closed off to shield against noise from the expressway and urban disturbances; the southern side features continuous balconies, which maximise sunlight whilst bringing the park's landscape into

the interior. On the western and southern sides, commercial residential towers are arranged in a relatively dispersed configuration to maximise views of the park. The undulating balconies shape the distinctive character of each building, creating a visual identity for the commercial residential units that is similar yet distinct from that of the social housing. Furthermore, the primary colour scheme of the buildings engages in a dialogue with the surrounding existing urban environment, whilst the materials used for the balconies provide a point of differentiation.



Figure 2.15 Venice ex-Junghans residential area (Source: <https://www.zucchiarchitetti.com/>)



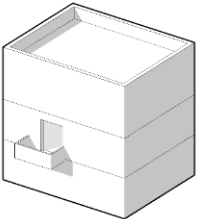
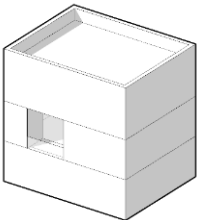
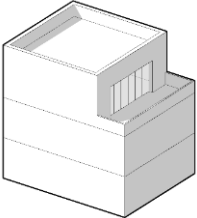
Figure 2.14 Nuovo Portello residential area in Milan (Source: Self-taken photo, <https://www.zucchiarchitetti.com/>)

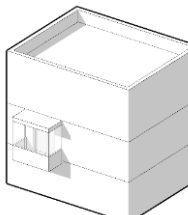
2.3 Classification of Balcony Types and Area Calculation Methods in Italian Building Regulations

2.3.1 Classification of Balcony Types in Italy

The Italian Standard Building Regulations (Regolamento Edilizio Tipo) ^[67] classify balconies into four categories based on their characteristics: projecting balconies, recessed balconies, terraces and enclosed balconies. Among these, a projecting balcony (balcone) is defined as “open on at least two sides and projecting horizontally”; a loggia is “covered, does not project outwards, and is open on at least one side”, and often features a continuous façade resembling a colonnade; a terrace (terrazza) is “uncovered” and is generally situated on the roof of a building; a veranda is “enclosed on all sides by glass or transparent waterproof elements, which may be partially or fully opened”.

Table 2.1 Classification of Balconies

Type in Chinese and in English	Corresponding Italian	Standard Definition	Illustration Description
凸阳台 Projecting balcony	balcone	structural element that is open on at least two sides and accessible, featuring a horizontal projection, fitted with a railing or parapet, and accessible directly from one or more internal rooms.	
凹阳台 Recessed balcony	loggia/ loggiato	A covered, non-projecting, accessible architectural element, open on at least one side, fitted with balustrades or parapets, and accessible directly from one or more internal rooms.	
露台 Terrace	terrazza	An uncovered, easily accessible architectural element used to cover part of a building, fitted with balustrades or parapets, and accessible directly from one or more internal rooms.	

封闭阳台 Enclosed balcony	veranda	A covered room or space with the characteristics of a veranda, balcony, terrace or porch, enclosed on all sides by glass or transparent waterproof elements, which can be opened partially or fully.	
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2.3.2 Methods for Calculating Balcony Area in Italy

Under Italian building regulations, the method for calculating balcony area varies depending on the balcony's characteristics and intended use.

- (1) Uncovered projecting balconies are not included in the floor area calculation; for open-air balconies, 60% of the area is used to calculate the relevant construction fees.**

The Standard Building Regulations^[67] stipulate that gross floor area (SL, superficie lorda) refers to the sum of the areas of all storeys within the building's external envelope, which includes the area of recessed balconies but excludes the area of uncovered projecting balconies that protrude beyond the building's envelope. This metric is primarily used for floor area ratio (FAR) calculations to assess a project's construction intensity.

In terms of area classification, various types of open balconies—such as projecting balconies, recessed balconies and terraces—are classified as ancillary spaces, and their areas are included in the ancillary area (SA, superficie accessoria); whereas enclosed balconies, as indoor spaces suitable for long-term use, are included in the usable area (SU, superficie utile). When applying for a building permit, ancillary areas—including open balconies—are converted at a rate of 60%, whilst usable areas—including enclosed balconies—are counted in full towards the total floor area (SC, superficie complessiva), which serves as the basis for calculating municipal taxes and other fees. Consequently, as enclosed balconies are classified as usable areas, they are included in full in the total floor area for the purposes of paying the relevant fees. Overall, compared to the frequent adjustments to balcony floor area calculation rules in some regions of China, the conversion ratios for balcony areas in Italy are relatively stable.

Table 2.2 Key Area Concepts Involved in Balcony Calculations

Abbreviation	Concept	Definition
SU	Usable Area (superficie utile)	The net area inside a room. Excludes walls, columns, door and window openings, and any ancillary spaces
SA	Ancillary Area (superficie accessoria)	The area of ancillary functional spaces, such as: balconies, terraces, porches, communal corridors, stairwells, lift shafts, cellars, basements, attics, garages, passageways, etc. It also excludes walls, door and window openings, etc.
SL	Gross Floor Area (superficie lorda)	The sum of the areas of all storeys within the building's external envelope. Primarily used to calculate the plot ratio
SC	Total Area (superficie complessiva)	$SC = SU + 60\% SA$

(2) Open balconies are included in the cadastral area at a rate of 30%.

The Italian residential cadastral area (superficie catastale) is primarily used for property registration and serves as the basis for property owners to pay property tax, waste collection tax and other charges to the tax authorities. It is usually determined by the competent authorities through on-site surveying after the building is completed. According to the rules for calculating residential cadastral area, if a balcony or terrace constitutes ‘an exclusive ancillary space belonging to a single residential unit and directly connected to the main structure’, it is included in the calculation at a rate of 30% for the first 25 m² and 10% for any area exceeding that.^①

(3) In property transaction valuations, the calculation of balcony area follows local regulations.

Unlike the aforementioned planning and cadastral contexts, in property transactions and valuations, there is generally no national standard for the conversion of balcony area; instead, local industry regulations regarding saleable area (superficie commerciale) must be followed. Influenced by local chambers of commerce, industry associations and technical regulations, there are significant variations in the conversion ratios for different

^①Decreto del Presidente della Repubblica 23 marzo 1998, n. 138. Allegato C: Norme tecniche per la determinazione della superficie catastale delle unità immobiliari a destinazione ordinaria (Gruppi R, P, T)[EB/OL]. (1998-05-12)[2026-04-21].
https://www.gazzettaufficiale.it/atto/serie_generale/caricaArticolo?art.codiceRedazionale=098G0190&art.dataPubblicazioneGazzetta=1998-05-12&art.flagTipoArticolo=3&art.idArticolo=1&art.idGruppo=4&art.idSottoArticolo=1&art.idSottoArticolo1=10&art.progressivo=0&art.versione=1.

types of balconies across cities. In Rome, according to the standards of the local real estate industry association, uncovered balconies and terraces are calculated at 25%, balconies with a roof and enclosed on both sides are calculated at 35%, and enclosed balconies are calculated at 60%^①; In Milan, according to the technical regulations of the local chamber of commerce, projecting balconies are calculated at 50%, whilst recessed balconies are calculated at two-thirds^②; in Turin, according to the chamber's guidelines, projecting balconies are calculated at 50%, recessed balconies at 60%, and enclosed balconies at 70%, with these ratios generally aligning closely with those in Milan^③. It is thus evident that the method of calculating balcony area in property valuations exhibits strong regional characteristics. Comparing the conversion rules across the three cities, Rome's conversion factors for balcony areas are relatively low. To a certain extent, this implies that the local market applies a more lenient valuation approach to larger balconies, thereby creating more favourable market conditions for the installation of larger balconies.

2.4 Summary of this chapter

This chapter has established a foundational framework for identifying the characteristics and developmental trends of balconies in Italian apartment blocks, drawing upon both historical evolution and regulatory frameworks.

In terms of historical evolution, the balcony, as a key component of Italian apartment blocks, has gradually evolved alongside the development of housing. The earliest prototypes of the balcony can be traced back to the wooden cantilevered structures of the spectator stands in ancient Roman amphitheatres, which were also adopted in apartment blocks. Renaissance-era aristocratic residences often featured cantilevered balconies at the centre of the main floor or gallery-style balconies on the top floor, forming the prototype for apartment building balconies. From the 19th century onwards, against a backdrop of expanding housing construction, the spread of public health awareness and advances in metalworking technology led to the increasingly widespread inclusion of balconies in residential buildings. Their forms became increasingly lightweight, with cast-iron railings widely adopted to enhance their decorative appeal. In block-style

① Borsa Immobiliare di Roma. Indicazioni e avvertenze. [EB/OL]. [2026-03-15]. <https://www.bii.it/uploads/6450e6ff4da7c.pdf>.

② Camera di Commercio Milano. Usi tecnici[EB/OL]. [2026-03-15]. <https://www.milomb.camcom.it/documents/d/guest/estratto-usi-immobili-al-31-gennaio-2013>.

③ Camera di Commercio Torino; OICT. Per l'esame del mediatore. [EB/OL]. [2026-03-15]. https://www.to.camcom.it/sites/default/files/agenti-mediatori/manuale_Mediatori_WEB.pdf.

housing, balconies gradually evolved into distinct types facing the street and the inner courtyard. Entering the 20th century, the development of technologies such as reinforced concrete significantly increased the structural flexibility of balconies, leading to innovative forms that became a key element in shaping residential façades. In recent years, there has been growing attention to the ecological value of balconies in residential design, giving rise to diverse explorations involving increased floor area, expanded functionality and optimised forms.

At the level of policy and regulations, the classification of balcony types in Italy is detailed, and the rules for calculating floor area are clear. Uncovered projecting balconies are not included in floor area calculations, whereas recessed balconies are; open balconies are counted as 60% of the gross floor area for the calculation of relevant charges and as 30% of the cadastral area. At the same time, the conversion ratios for floor area in property valuations vary across different cities, and these differences may further influence the overall dimensions of balconies in different urban contexts.

It is evident, therefore, that the development of balconies in Italian apartment blocks has been shaped, on the one hand, by historical prototypes, structural techniques and urban form, and, on the other, by the practical constraints of classification standards and area calculation rules. The combined effect of these factors provides both a historical reference and a policy context for analysing the evolution of contemporary Italian residential balcony design.

Chapter 3 Case Study Collection Construction and Multi-dimensional Data Analysis

This chapter focuses on the construction of an Italian residential case study collection, data extraction and data analysis, with the aim of elucidating the overall characteristics of the sample and laying the groundwork for subsequent discussion. It begins with an overview of the general context of residential construction in Italy, outlining the principles of sample collection and selection, and presenting basic information about the case study collection. It then introduces the methods of data analysis, extraction and coding. Building on this, descriptive statistics and correlation tests are conducted across three dimensions—project, unit and balcony—to extract multidimensional information from the case study collection.

3.1 Residential Project Sample Collection and Case Study Collection Construction

3.1.1 Trends in Italy's Demographic Changes

(1) Population peaks and declines gradually, entering a phase of profound population ageing

From 2010 to 2024, following the peak in Italy's total population (60.32 million in 2014), a gradual decline has occurred. The ageing rate (the proportion of the population aged 65 and over) has risen from 20.46% to 24.62%^①, continuing a rapid trend and marking the country's entry into a phase of profound population ageing. The phenomenon of an ageing population with a low birth rate is becoming increasingly pronounced, with the ageing index (indice di vecchiaia)^② rising from 144.4 (in 2010) to 207.7 (in 2025), meaning that for every child aged 0–14, there are more than two people aged 65 and over.

(2) Household sizes are shrinking, with single-person households accounting for over one-third

The structure of Italian households is becoming increasingly simplified, with household sizes continuing to shrink. Between 2009 and 2024, the average household size fell from 2.6 persons per household to 2.2 persons per household, whilst the proportion

① Data source: <https://data.worldbank.org/country/italy>

② Aging Index (Indice di vecchiaia) = Population aged 65 and over / (Population aged 0–14) × 100. Data source: <https://demo.istat.it/tavole/?t=indicatori>

of single-person households rose from 28.1% to 36.2%. The proportion of two-person households remained stable at around 28%, whilst the proportions of three-person, four-person and larger households all declined.

3.1.2 Overview of New Residential Projects

(1) Residential construction remains at a low level with slight fluctuations, shifting towards quality improvement

According to Italian building permit data (permesso di costruire), residential construction showed an overall upward trend in the early 2000s^①, but declined rapidly following the 2008 financial crisis, reflecting the impact of the economic downturn on the sector during that period. Since 2014, the decline in total residential construction has slowed, with figures fluctuating at a low level compared to previous periods^②.

In 2021, the per capita living space in Italy stood at 44.3 m², an increase of 8.8% compared to 2011^③. Although Italy has faced issues of negative population growth and an ageing population in recent years, the total volume of housing construction has stabilised and per capita living space has increased, reflecting a shift in housing development from quantitative expansion towards the renewal of existing stock and improvements in quality.

① Delmendo L C. Italy's residential property market analysis 2025[EB/OL]. [2026-03-15]. <https://www.globalpropertyguide.com/europe/italy/price-history>.

② 数据来源: Istat. Statistiche sui permessi di costruire: anno 2024[DB/OL]. [2026-03-15]. <https://www.istat.it/tavole-di-dati/statistiche-sui-permessi-di-costruire-anno-2024/>.

③ 意大利住宅按户型面积计算, 不包括楼道等公摊面积。数据来源: Istituto Nazionale di Statistica. Today-Abitazioni[R/OL]. [2026-03-15]. https://www.istat.it/wp-content/uploads/2024/08/Today-Abitazioni_01_08-2024.pdf.

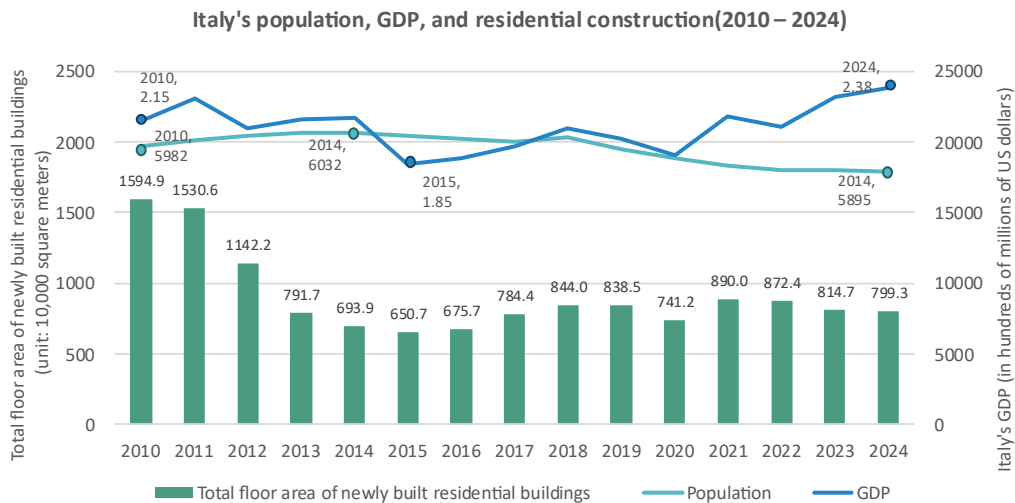


Figure 3.1 Trends in Italy's population, GDP, and residential construction (2010-2024) (Data source: Self-drawn based on <https://www.istat.it/> and <https://data.worldbank.org/>)

(2) The average net usable floor area per household in new residential properties is 85.2 m², which is smaller than that of existing residential properties.

Compared with fluctuations in total volume, the relevant data for the average residential building and the average household remain relatively stable. From 2010 to 2024, the average floor area per new residential building was 467.1 m², with an average of 3.13 households per building, and the average net usable floor area (superficie utile abitabile) per household was 85.2 m².^①

To facilitate a comparative analysis with the situation in China, the following four points should be noted: (1) In Italy, building permits are required for the construction of new residential buildings, demolition and reconstruction, and major renovation projects involving changes to building volume or form; therefore, these figures reflect not only new development projects but also urban regeneration projects. (2) This statistical scope also includes detached houses and rural dwellings, neither of which fall within the scope of this study. (3) The gross floor area (superficie totale) shown in the charts includes shared areas such as lifts and communal corridors, whereas the net usable area excludes the area of ancillary spaces such as internal and external walls, columns and balconies. (4) In Italy, apart from bedrooms, a separate living room is counted as a room (stanza) and included in the statistics, whilst bathrooms, kitchens and storage rooms are regarded

^① Data source: Istat. Statistiche sui permessi di costruire: anno 2024[DB/OL]. [2026-03-15]. <https://www.istat.it/tavole-di-dati/statistiche-sui-permessi-di-costruire-anno-2024/>.

as service spaces and are not included in the statistics. For example, a ‘studio’ flat without a separate bedroom in China is referred to as a ‘one-room flat’ (monolocale) in Italy; a flat known as a ‘one-bedroom with living room’ in China is called a ‘two-room flat’ (bilocale) in Italy; a flat known as a ‘two-bedroom with living room’ in China is termed a ‘three-room flat’ (trilocale), and so on; It can therefore be inferred that the average number of bedrooms is likely lower than this figure.

In 2023, the average net usable floor area per household for all occupied dwellings (abitazioni occupate) in Italy was 101.3 m², with an average of 93.5 m² for urban dwellings and 110.0 m² for rural dwellings; this data reflects the state of Italy’s housing stock. A comparison with data on newly built dwellings reveals that the average net floor area per dwelling for new builds between 2010 and 2024 was lower than the average for the existing stock. This may be linked to recent social trends towards simpler household structures and smaller household sizes.

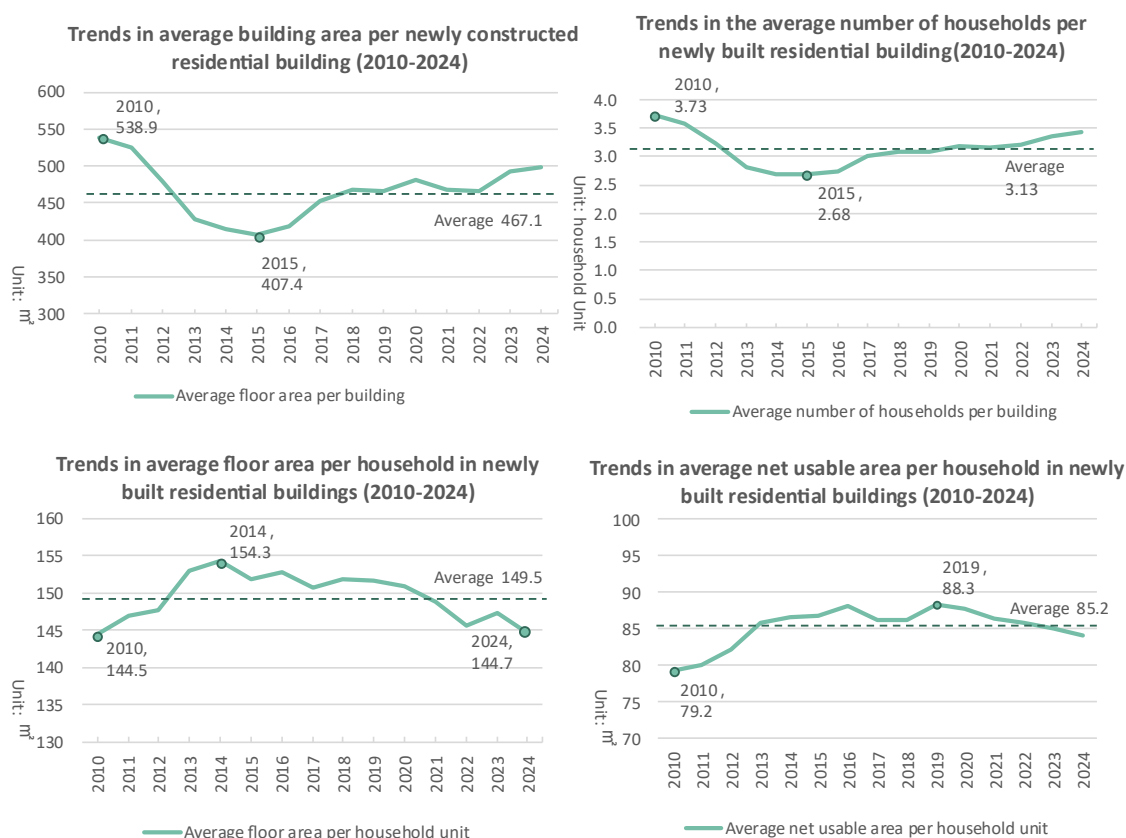


Figure 3.2 Average new residential housing construction in Italy, 2010-2024

(Source: <https://www.istat.it/>)

3.1.3 Source of Case Studies and Selection Criteria

According to statistics, a total of 288,909 residential projects were constructed across Italy between 2010 and 2024, of which 22,209 were located in the three cities of Rome, Milan and Turin ^[68]. On this basis, a purposive sampling method was employed, with the sample size determined as 5% of the total number of projects in these three cities (approximately 111). Project information was gathered through academic publications, specialist journals, online media and property listing websites. The basic data extracted from these sources included floor plans of buildings and unit layouts, as well as photographs of building façades. In addition, the sample was supplemented through interviews with housing experts to enhance its representativeness.

To further improve the accuracy and scientific rigour of the study, field surveys were conducted on selected projects, yielding a wealth of first-hand data. During these site visits, records were taken of the projects and their surroundings, including their location, scale, overall façade appearance, balcony construction details, usage patterns, greening, and shading arrangements; random interviews were also conducted with residents to gain a preliminary understanding of basic project information, actual living experiences, and daily usage patterns of residential balconies. As residential projects are privately owned, unrestricted access for inspection was not possible. To obtain information on residential usage and expand the scope of project data, we sourced photographs of interiors and balconies from commercial property sales websites and popular local Italian second-hand property platforms.

Table 3.1 Case Study Collection: Sources of Secondary Information

No.	Type	Example
1	Monographs on contemporary Italian housing	[1] Menegatti, F. (2012). <i>Itinerari italiani del la residenza collettiva</i> . Gangemi. [2] Stenti, S. (2023). <i>Housing in Italia: dalle case popolari all’edilizia social e privata, 1903-2015</i> . [3] Rossipro di Associati et al. (2016) <i>Social housing: Milano, via Cenni</i> . Macerata: Quodlibet.
2	Urban architectural guidebooks	[1] Chiorino,C.et al.(2015) <i>Architectural guide: Turin</i> . Berlin: DOM.
3	Architectural journal articles	Domus, Casa Bella, A+U

4	Architectural media	[1] https://archidiap.com/opera/citta-del-sole/
		[2] https://www.theplan.it/eng/award-2019-housing/social-housing-alloggi-sostenibili-nel-quartiere-primavalle
5	Architectural practice websites	https://www.studiotransit.com/portfolio-item/sustainable-apartments-in-casal-bertone/
6	Property sales websites	[1] https://fronteparco.com/gli-appartamenti/
		[2] https://www.socialvillagecm.it/appartamenti/patto-di-futura-vendita/
7	Second-hand property websites	https://www.immobiliare.it/ , https://www.idealista.it/

The case selection criteria are as follows: 1) Time: Completed between 2010 and 2026. 2) Location: Located in Rome (Roma Capitale), Milan (Comune di Milano) or Turin (Città di Torino). 3) Function: The selection includes only social housing and private residential projects designed to meet long-term housing needs; projects such as student accommodation and rental housing for the elderly, which are limited to specific target groups, as well as short-term accommodation such as short-let flats and refugee shelters, are excluded from the case collection. 4) Completeness of data: For projects where only field survey information is available and architectural drawings are difficult to obtain, these have been excluded from the final case collection for the sake of research convenience.

3.1.4 Description of the Case Study Collection

Following data collection, field research, information supplementation and case selection, the residential case study collection for this research was finalised. The collection comprises a total of 96 residential cases, of which 20 are located in Rome, 50 in Milan and 26 in Turin. Of the 96 cases, 44 were subject to on-site surveys, accounting for 45.8%. As some projects in the collection comprise multiple flat types, and some flat types feature multiple balconies, a total of 162 flat types and 221 balconies were identified. Hereinafter, the term ‘case collection’ will refer to this set of residential project cases; details regarding the names and locations of the included cases are provided in Appendix A.



Figure 3.3 Distribution of case studies by city and completion time (Data source: self-drawn)

3.2 Data Analysis Methods and Information Extraction and Coding

3.2.1 Data Analysis Methods

This paper employs a combined approach of typological induction and statistical analysis to extract case data.

At the level of typological induction, information was annotated for 96 projects, drawings were produced for 162 flat layouts, and morphological analysis was conducted on 221 balconies. Characteristics relating to construction conditions, flat layout features, balcony configurations and interface design were identified to form an analytical framework and induce typical typologies. Based on this typological induction, a coding system was established to convert these various characteristics into standardised code values.



Figure 3.4 Unit Floor plan redrawn (green area represents balcony) (Source: Self-drawn)

In terms of statistical analysis, this paper first conducts descriptive statistics on the structured data generated from the coding process to identify the basic distributional characteristics of the sample. Depending on the data type of each variable, graphical representations such as bar charts, pie charts, histograms, box plots and scatter plots are used to illustrate their frequency distributions, proportional compositions, measures of dispersion and relationships between variables. Bar charts and pie charts are primarily used to present the composition of nominal categorical variables; histograms are used to observe the distribution ranges and central tendencies of continuous quantitative variables; box plots are used to compare the medians, interquartile ranges and outliers of data across different groups; and scatter plots are used to identify trends and clustering patterns among continuous quantitative variables. Building upon descriptive statistics, appropriate cross-tabulation methods are selected based on the type of variable to test for associations between variables and their significance. Specifically, correlation analysis is primarily used for relationships between continuous quantitative variables; cross-tabulation is primarily used for relationships between categorical variables; and comparisons of differences between groups are primarily used for relationships between discrete quantitative variables and nominal categorical variables.

3.2.2 Extraction and Coding of Case Information

Case information was categorised, extracted and coded according to the basic unit of analysis, resulting in three dimensions: project, flat type and balcony. A total of 33 codes were generated, comprising 15 for the project dimension, 8 for the flat type dimension and 10 for the balcony dimension.

(1) Project Dimension Attribute Coding

The project dimension uses residential projects as the basic unit of analysis and employs attribute coding across five aspects: spatio-temporal distribution, site development conditions, type and scale, balcony configuration, and balcony interface details, totalling 15 codes. Projects are coded using the ‘city code–case number’ format, where the city codes R stands for Rome (Roma), M for Milan (Milano), and T for Turin (Torino). Each case is first grouped by city, then sorted by year of completion from earliest to latest; the case number is the sequential number within the group. For example, “R-1” refers to the case located in Rome with the earliest completion date within the Rome group.

The section on the spatio-temporal distribution of projects comprises two codes: year of completion and location distribution. The project location distribution includes three types: historic city centre, modern built-up area and urban suburbs.

Table 3.2 Coding of Project Spatio-Temporal Distribution Attributes

No.	Attribute	Description	Data Type	Coding Method	Remarks
1	Year of Completion	Describes the year the project was completed	Discrete quantitative variable	/	The year the project was completed or the most recent renovation was finished.
2	Location Distribution	Describes the type of location within the urban area where the case is situated	Ordinal categorical variable	Historic city centre = 1; Modern built-up area = 2; Urban suburbs = 3	The boundaries of Rome's 'historic city centre' are defined with reference to the Aurelian Wall and correspond to the boundaries of the core area of Rome's World Heritage Site^①; the boundaries of Milan's historic city centre are defined with reference to the Spanish Wall and correspond to the administrative boundaries of Milan's 1st District; the boundaries of Turin's historic city centre are defined with reference to the Baroque-era city walls, with the specific boundaries corresponding to those of Turin's Limited Traffic Zone (ZTL). "Modern built-up area" refers to a contiguous urbanised area that developed primarily during the 20th century. "Urban fringe" refers to a low-density area formed by the expansion of the existing built-up area.

The 'Site Development Conditions' section comprises two codes: 'Development Method' and 'Original Building Function'. The 'Development Method' includes three types: 'New Development', 'Demolition and Reconstruction', and 'Retention and Refurbishment'. The 'Original Building Function' includes seven types: 'Residential', 'Office', 'Warehousing and Industrial', 'Transport', 'Commercial', 'Urban Vacant Land', and 'Other'.

① Historic Centre of Rome, the Properties of the Holy See in that City Enjoying Extraterritorial Rights and San Paolo Fuori le Mura. World Heritage Convention. <https://whc.unesco.org/en/list/91/>

Table 3.3 Attribute Codes for Project Site Development Conditions

No.	Attribute	Description	Data Type	Coding Method	Remarks
1	Development Method	Describes the prior development status of the project site, as well as the relationship between new and existing buildings	Nominal categorical variable	New development = 1; Demolition and reconstruction = 2; Retention and renovation = 3	“New development” refers to the first construction of permanent buildings on the project site. “Demolition and reconstruction” refers to redevelopment following the demolition of all existing buildings on the site. “Retention and renovation” refers to development carried out whilst retaining all or part of the existing buildings.
2	Original Building Function	For demolition and reconstruction and retention and renovation projects, describes the land use nature and building function during the prior development phase	Nominal categorical variable	Residential = 1; Office = 2; Warehousing and Industrial = 3; Transport = 4; Commercial = 5; Urban Idle Land = 6; Other = 7	“Transport” includes land for existing railways and station buildings, land for road transport facilities, multi-storey car parks, etc. “Urban idle land” refers to land located within contiguous urbanised areas where the original buildings have been damaged or demolished and which has been closed off and left idle for a long period.

The ‘Scale Type’ section comprises five codes: site scale, building cluster configuration, total floor area, number of storeys, and housing type. Site scale includes three types: terraced, detached and whole-block; building cluster configuration includes two types: single-building and multi-building clusters; and housing type includes three types: social housing, commercial housing and mixed-use housing.

Table 3.4 Project Scale Type Attribute Codes

No.	Attribute	Description	Data Type	Coding Method	Remarks
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1	Site Scale	Describes the relationship between the project and neighbouring buildings, and between the project site and the block	Nominal categorical variable	Continuous Plot Type = 1; Independent Plot Type = 2; Isolated Block Type = 3	“Continuous Plot Type” refers to a block enclosed by urban roads that is subdivided into multiple plots, where common walls are shared with other buildings within the block. “Independent Plot Type” refers to a block that is subdivided into multiple plots, where common walls aren’t shared with other buildings. “Isolated Block Type” refers to a project site enclosed by urban roads that occupies the entire block.
2	Project Cluster Composition	Describes the number of independent buildings comprising the project	Dichotomous variable	Single-building type = 1; Multi-building cluster type = 2	/
3	Total Floor Area	Describes the total building scale of the residential project	Continuous quantitative variable	/	If the project comprises multiple functions such as residential and commercial, only the gross floor area of the residential component is counted.
4	Number of Storeys	Describes the number of above-ground storeys in the project	Discrete quantitative variable	/	The statistical scope covers the number of storeys from the ground floor upwards, including the ground floor. If the project comprises multiple buildings, or if a single building has varying heights, the number of the highest above-ground storey is taken.
5	Housing Type	Describes the type of housing provision within the project	Nominal categorical variable	Social housing = 1; Market housing = 2; Mixed housing = 3	“Mixed housing” refers to a project that includes both social housing and market housing.

The ‘Balcony Configuration’ section comprises two codes: ‘Balcony Cross-Section Configuration Type’ and ‘Balcony Elevation Configuration Type’. The ‘Balcony Cross-Section Configuration Type’ is categorised into four types: single-level, split-level, multi-level and terraced. The ‘Balcony Elevation Configuration Type’ is categorised into four types: independent, combined, staggered and corridor-style.

Table 3.5 Attribute Codes for Project Balcony Configuration

No	Attribute	Description	Data Type	Coding Method	Remarks
1	Balcony Cross-Section Configuration Type	Describes the cross-sectional arrangement of balconies within the project	Nominal categorical variable	Single-storey type = 1; Split-level type = 2; Multi-storey type = 3; Terraced type = 4	Single-storey type refers to a balcony with a single-storey height; split-level type refers to a balcony with a two-storey height; multi-storey type refers to a balcony with multiple storeys; terraced type refers to a balcony with a stepped, staggered arrangement.
2	Balcony Elevation Combination Type	Describes the arrangement of balconies in the project	Nominal categorical variable	Standalone = 1; Combined = 2; Offset = 3; Corridor = 4	Standalone refers to small-scale, protruding balconies distributed independently; Combined refers to balconies connected vertically or horizontally; Offset refers to balconies offset laterally; Corridor refers to multiple balconies connected horizontally.

The balcony interface details section comprises four codes: balcony openness, balcony parapet interface type, balcony shading type and balcony greening type. Balcony openness includes three types: open, enclosed and reversible glazing; the balcony parapet interface type comprises three types: opaque, semi-transparent and transparent; the balcony shading type comprises four types: flexible roll-up, adjustable components, fixed screening and vegetation shading; and the balcony greening type comprises two types: self-planted and centrally managed.

Table 3.6 Coding of Detailed Attributes for Project Balcony Interfaces

No	Attribute	Description	Data Type	Coding Method	Remarks
1	Balcony Openness	Describes whether the project's balcony interfaces are enclosed or open	Nominal categorical variable	Open type = 1; Enclosed type = 2; Reversibly enclosed type = 3	Open type refers to a project where all balconies are open; Enclosed type refers to a project where, in addition to open balconies, there are also enclosed balconies; Reversibly enclosed type refers to a project where, in addition to open balconies, there are also balconies with windows sealed using reversible technology.

2	Balcony Parapet Interface	Describes the degree of transparency of the balcony parapet interface	Nominal categorical variable	Opaque = 1; Semi-transparent = 2; Fully transparent = 3	Opaque refers to balconies with solid parapets; Semi-transparent refers to balconies using semi-transparent materials such as translucent glass, tinted glass, perforated metal panels and metal railings; Fully transparent refers to balconies using fully transparent glass. A single project may utilise multiple types of balcony parapet interfaces.
	Balcony Shading Type	Describes the type of balcony shading facility	Nominal categorical variable	Flexible roll-up type = 1; Adjustable component type = 2; Fixed screening type = 3; Vegetation shading type = 4	Flexible roll-up type refers to the use of fabric sun blinds, etc.; Adjustable component type refers to the use of blinds and movable track panels, etc.; Fixed screening type refers to the use of decorative panels, perforated panels and grilles, etc.; Vegetation shading type refers to the use of plants to provide shade. A single project may employ multiple types of balcony shading.
4	Balcony Greening Type	Describes the management methods and types of balcony greening	Nominal categorical variable	Self-planted type = 1; Centralised management type = 2	/

(2) Unit Dimension Attribute Coding

The unit dimension uses the unit as the basic unit of analysis, with attribute coding applied across three aspects: the overall characteristics of the unit, the combination of balcony numbers, and the ratio of balcony areas. This results in a total of eight codes. For units without a specified scale, this paper refers to standard residential door widths in Italy and uniformly scales the width of standard room doors to 0.8 m to derive dimensional data such as balcony width, depth and area. Units are coded using the format “City Code – Case Number – Number of Rooms – Drawing Number”, with the first two elements inherited from the respective project. To avoid ambiguity and in line with common domestic terminology, the term “number of rooms” in this paper specifically refers to the number of bedrooms within the dwelling; “drawing number” refers to the sequential number within a given case for floor plans with the same number of rooms; if there is only one such floor plan, it is recorded as 1. For example, “M-10-3-2” denotes the second three-bedroom unit in Case 10 (M-10) in Milan.

The section on general unit layout characteristics comprises three codes: number of rooms, floor area, and type of natural lighting. The type of natural lighting includes four categories: single-sided, corner double-sided, through-room double-sided, and end-unit triple-sided.

Table 3.7 Attribute Codes for General Unit Information

No.	Attribute	Description	Data Type	Coding Method	Remarks
1	Number of Rooms	/	Discrete quantitative variable	One-bedroom = 1; two-bedroom = 2; three-bedroom = 3; four-bedroom and above = 4	the term “number of rooms” as used in this document specifically refers to the number of bedrooms within the unit.
2	Unit Area	Describes the floor area of the unit	Continuous quantitative variable	/	Unit Area is calculated by taking the centre line of partition walls and the full length of external walls. Two statistical methods are used: “excluding balconies” and “including the full area of balconies”. “Single-sided natural lighting” refers to a unit with only one side directly facing the exterior, typically located in the middle of a building block.
3	Natural Lighting Type	Describes the number of external light-facing surfaces and their relative positions	Nominal categorical variable	Single-sided natural lighting = 1; Corner double-sided natural lighting = 2; Through-type double-sided natural lighting = 3; End-unit triple-sided natural lighting = 4	“Corner double-sided natural lighting” refers to a unit with two adjacent sides directly facing the exterior, which are perpendicular to each other, typically located at the corner of a building block. “Through-apartment double-sided natural lighting” refers to a unit with two non-adjacent sides directly facing the exterior, which are parallel to each other; these units are typically located in the middle of the building. “End-unit triple-sided natural lighting” refers to a unit with three contiguous sides directly facing the exterior; these units are typically located at the ends of the building.

The section on the combination of balcony numbers in unit layouts comprises two codes: ‘Number of Balconies’ and ‘Combination of Multi-Balcony Layouts’. The latter includes four types: same-side layout, corner layout (on both sides), through-layout (opposite sides), and end-of-corridor layout (on three sides).

Table 3.8 Attribute Codes for the Combination of Balcony Numbers in Unit Layouts

No.	Attribute	Description	Data Type	Coding Method	Remarks
1	Number of Balconies	/	Discrete Quantitative Variable	/	The statistical scope refers to the number of balconies within a unit that are not directly connected to one another.
2	Combination of Balcony Locations	For units with two or more balconies, this describes the relative positional relationships between the balconies	Nominal Categorical Variable	Same-side layout = 1; Corner layout (on both sides) = 2; Through-hall layout (opposite sides) = 3; End-of-corridor layout (three sides) = 4	“Same-side layout” refers to two or more balconies located on the same façade. “Corner layout (on both sides)” refers to two or more balconies located on two mutually perpendicular façades. “Through-hall layout (opposite sides)” refers to two or more balconies located on two mutually parallel façades. “End-of-corridor layout (three sides)” refers to two or more balconies located on three consecutive façades.

The section on balcony area ratios for unit layouts comprises three codes: total balcony area, balcony area ratio, and facade balcony coverage. The balcony area ratio refers to the proportion of the balcony area within the total floor area of the unit (calculated inclusive of the balcony); the facade balcony coverage refers to the proportion of the total balcony width relative to the total length of the unit’s external light-receiving perimeter.

Table 3.9 Attribute Codes for Unit Balcony Area Ratios

No.	Attribute	Description	Data Type	Coding Method	Remarks
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1	Total Balcony Area	Describes the total area of balconies within the unit	Continuous quantitative variable	/	Calculated based on the “total balcony area” definition; if the unit contains multiple balconies, their total area is counted.
2	Balcony Area Ratio	Describes the proportion of the balcony area within the unit relative to the total unit area	Continuous quantitative variable (0–1)	/	Refers to the ratio of the balcony area (total area) to the total unit area (calculated using the “total balcony area” methodology).
3	Balcony Facade Coverage	Describes the proportion of the total balcony width relative to the total length of the unit’s external light-receiving perimeter	Continuous quantitative variable (0–1)	/	If a dwelling unit has two or more balconies, their total width is calculated; if a unit has two or more light-receiving facades, the total length of their light-receiving external contour lines is calculated. For balconies projecting from the main building volume, the width and corresponding facade length are calculated based on the inner edge of the balcony; for balconies recessed from the main building volume, the width and corresponding facade length are calculated based on the outer edge of the balcony.

(3) Balcony Dimension Attribute Coding

The balcony dimension uses the individual balcony as the basic unit of analysis, with attributes coded across four aspects—form, orientation, dimensions and function—comprising a total of 10 attributes. Balconies are identified using the format “City Code–Case Number–Number of Rooms–Drawing Number–Balcony Number”, with the first four elements inherited from the corresponding unit; for units with a single balcony, the “Balcony Number” is recorded as 1. For example, “T-19-1-2-2” refers to the second balcony in the second one-bedroom unit within Case No. 19 (T-19) in Turin.

The section on balcony configurations comprises three codes: plan shape, structural support method and relative contour position. Plan shapes include convex (rectangular types and their variations), single-recessed (L-shaped and variants) and other (U-shaped, sawtooth, etc.); structural support methods include non-cantilevered, cantilevered and mixed; relative contour positions include recessed, projecting and mixed.

Table 3.10 Balcony Morphology Attribute Codes

N Attrib o. ute	Description	Data Type	Coding Method	Remarks
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1	Plan Shape	Describes the plan shape of the balcony	Nominal categorical variable	Convex type (rectangular and variants) = 1; Single-recessed type (L-shaped and variants) = 2; Other (U-shaped, sawtooth, etc.) = 3	This document simplifies the description of balcony plan shapes to their convex or recessed characteristics; therefore, no further distinction is made between straight or curved contour lines.
2	Structural Support Method	Describes the structural support method of the balcony	Nominal categorical variable	Non-cantilevered = 1; Cantilevered = 2; Mixed type = 3	“Mixed type” refers to a balcony where part of the structure is non-cantilevered and part is cantilevered.
3	Relative Contour Position	Describes the positional relationship of the balcony relative to the façade contour line of the main building volume	Nominal categorical variable	Recessed balcony = 1; Projecting balcony = 2; Mixed type = 3	“Mixed type” refers to a balcony where part is relatively recessed and part is relatively projecting. “Structural support method” and “relative contour position” are recorded separately to more accurately describe the spatial nature of the balcony.

The balcony orientation section comprises two codes: interface orientation and connectivity. Interface orientation includes three types: no distinct orientation, facing the external street, and facing the interior of the site; connectivity includes various types such as connection to the living room, bedroom, separate kitchen, and bathroom.

Table 3.11 Balcony Orientation Attribute Codes

No.	Attribute	Description	Data Type	Coding Method	Remarks
1	Facade Orientation	Describes the relative position of the balcony within the building plan	Nominal categorical variable	No distinct orientation = 0; Facing external street = 1; Facing internal courtyard = 2	“No distinct orientation” refers to tower-block residential buildings where the plan orientation is unclear, or where existing data is insufficient to determine the facade orientation. As unit floor plans typically lack information such as a compass rose, this study does not make judgements regarding the actual compass direction of the balcony.

2	Conn ectivi ty	Describes the types of functional spaces to which the balcony is directly connected within the unit	Multi- label categ orical varia ble	Connected to living room (with open-plan kitchen), connected to separate kitchen, connected to bedroom A, connected to bedroom B, connected to service spaces such as bathrooms (values 0/1, where 1 indicates connected and 0 indicates not connected)	In some small-sized residential units, cupboards are installed within the living room to integrate the open-plan kitchen with the living area; this paper combines such spaces with those serving solely as living areas under the category of 'living room'.
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The balcony dimensions section comprises three codes: width, depth and width-to-depth ratio. Width refers to the length of the balcony as projected along the façade; depth refers to the average length of the balcony perpendicular to the width; and the width-to-depth ratio refers to the ratio of width to depth.

Table 3.12 Balcony Dimensions Attribute Codes

N o.	Attrib ute	Descriptio n	Data Type	Coding Metho d	Remarks
1	Width	Describes the length of the balcony as it extends along the façade	Conti nuous quant itativ e varia ble	/	For balconies recessed from the main building volume, the width is calculated based on the outer edge of the balcony; for balconies projecting from the main building volume, the width is calculated based on the inner edge of the balcony; for balconies with a "Relative Contour Position" of "Mixed", the width is calculated based on the overlapping area between the outer contour line of the main building volume and the balcony.
2	Depth	Describes the average length of the balcony perpendic ular to the width	Conti nuous quant itativ e varia ble	/	For balconies with non-uniform depth, the average depth is taken
3	Width-to- Depth Ratio	Describes the ratio of the length to the width of the balcony plan	Conti nuous quant itativ e varia ble	/	/

The balcony function section comprises two codes: function type and furniture type. Function types include five categories: leisure, housework, storage, gardening and other; furniture types include two categories: table and chair furniture and fixed furniture.

Table 3.13 Balcony Function Attribute Codes

N o.	Attribute	Description	Data Type	Coding Method	Remarks
1	Functional Type	Describes the functions served by the balcony	Nominal categorical variable	Leisure=1; Housework=2; Storage=3; Gardening=4; Other=5	A single balcony may serve multiple functions.
2	Furniture Type	Describes the configuration of balcony furniture	Nominal categorical variable	Table and chair furniture=1; Fixed furniture=2	Fixed furniture refers to relatively immovable items such as sofas and built-in cupboards.

The aforementioned coding system extracts and organises information from the case studies across three dimensions: project, unit and balcony. There are a total of 21 codes relating to balcony characteristics, including balcony width, depth, width-to-depth ratio, plan shape, structural support method, relative position within the building envelope, orientation, connectivity, functional type and furniture type (balcony dimension); number of balconies per unit, spatial relationships between multiple balconies, total balcony area, proportion of balcony area, and façade coverage (unit layout dimension); and sectional configuration type, façade configuration type, degree of openness, balustrade type, shading type, and landscaping type (project dimension).

This coding system encompasses two categories of information: quantitative variables and categorical variables. Quantitative variables can be further divided into continuous quantitative variables (e.g. total floor area, balcony area, balcony depth) and discrete quantitative variables (e.g. year of completion, number of storeys); categorical variables can be further classified into binary categorical variables (e.g., building cluster composition), nominal categorical variables (e.g., unit lighting type, balcony orientation), ordinal categorical variables (e.g., case location distribution) and multi-label categorical variables (e.g., balcony connectivity relationships). The classification of the aforementioned variable types provides a basis for the selection of subsequent statistical

analysis methods.

3.3 Case Study Collection Data Overview

Based on project dimension coding, a descriptive statistical analysis was conducted on eight aspects of the 96 projects in the case study collection, including geographical distribution, construction method, original building function, site scale, building cluster composition, floor area, number of storeys and housing type. This was supplemented by cross-tabulation analyses taking into account the cities in which the projects are located.

3.3.1 Data Analysis by Project Dimension

Table 3.14 Data Analysis by Project Dimension

Project Dimension (N=96)	Category	Sample size	Percentage (%)
City of location	Rome	20	20.8
	Milan	50	52.1
	Turin	26	27.1
Housing type	Private housing	77	80.2
	Social housing	15	15.6
	Mixed housing	4	4.2
Construction method	Redevelopment	52	54.2
	Refurbishment	20	20.8
	New build	24	25.0
Location	Historic city centre	1	1.0
	Modern built-up area	79	82.3
	Urban suburbs	16	16.7
Number of storeys	4-6 storeys	30	31.3
	7-11 storeys	52	54.2
	12-34 storeys	14	14.5

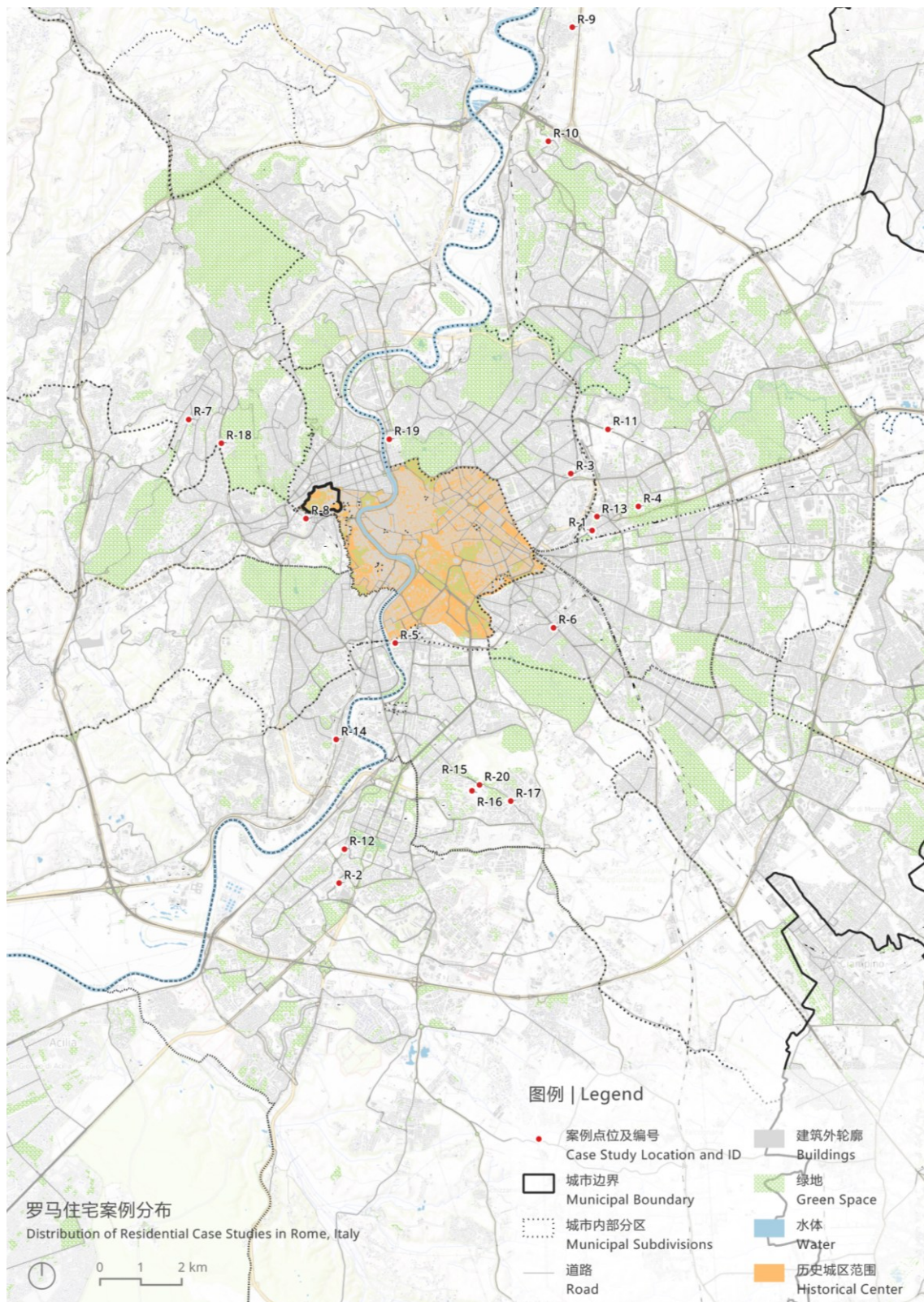


Figure 3.5 Distribution of residential projects in Rome (Source: self-drawn)

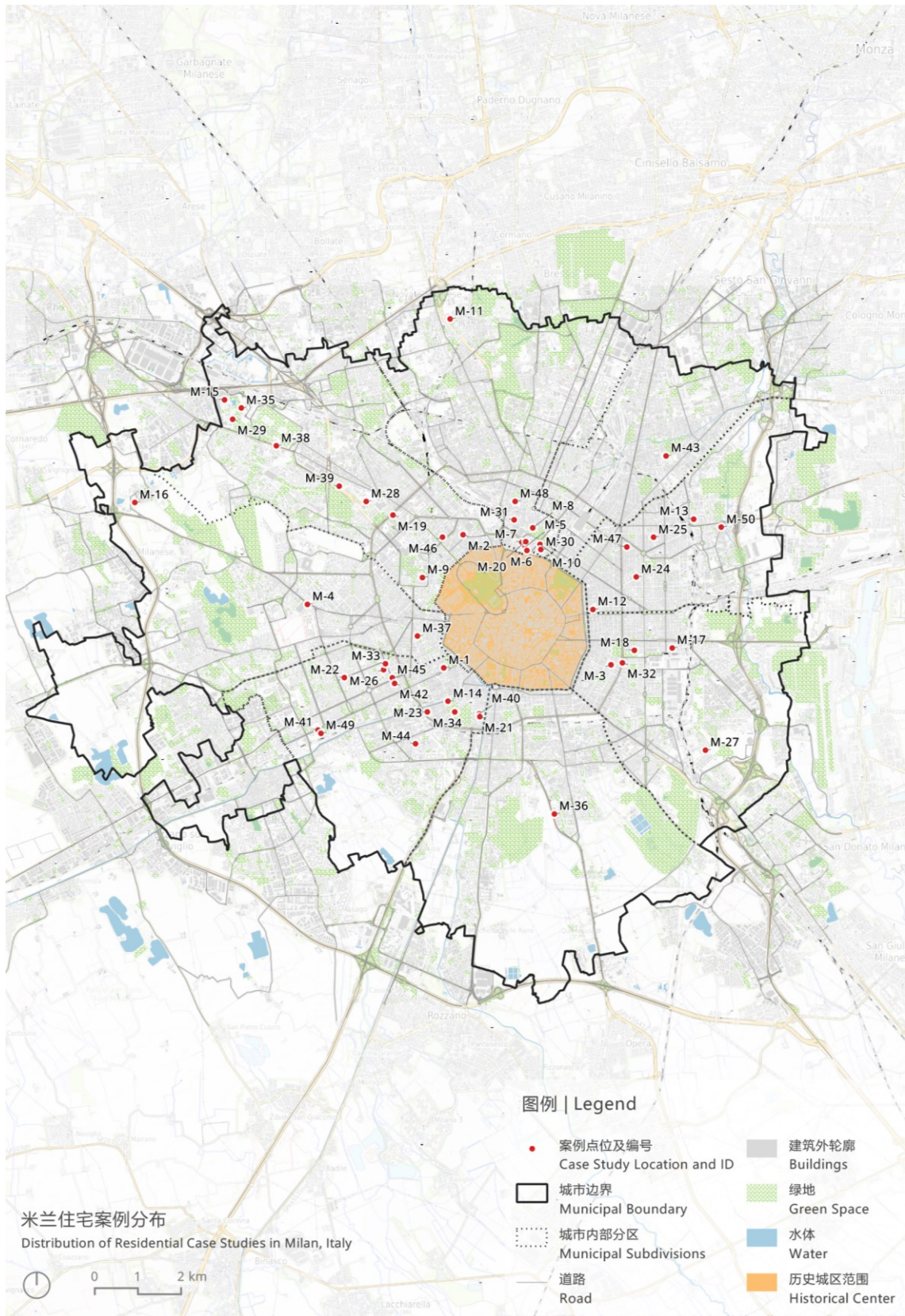


Figure 3.6 Distribution of residential projects in Milan (Source: self-drawn)

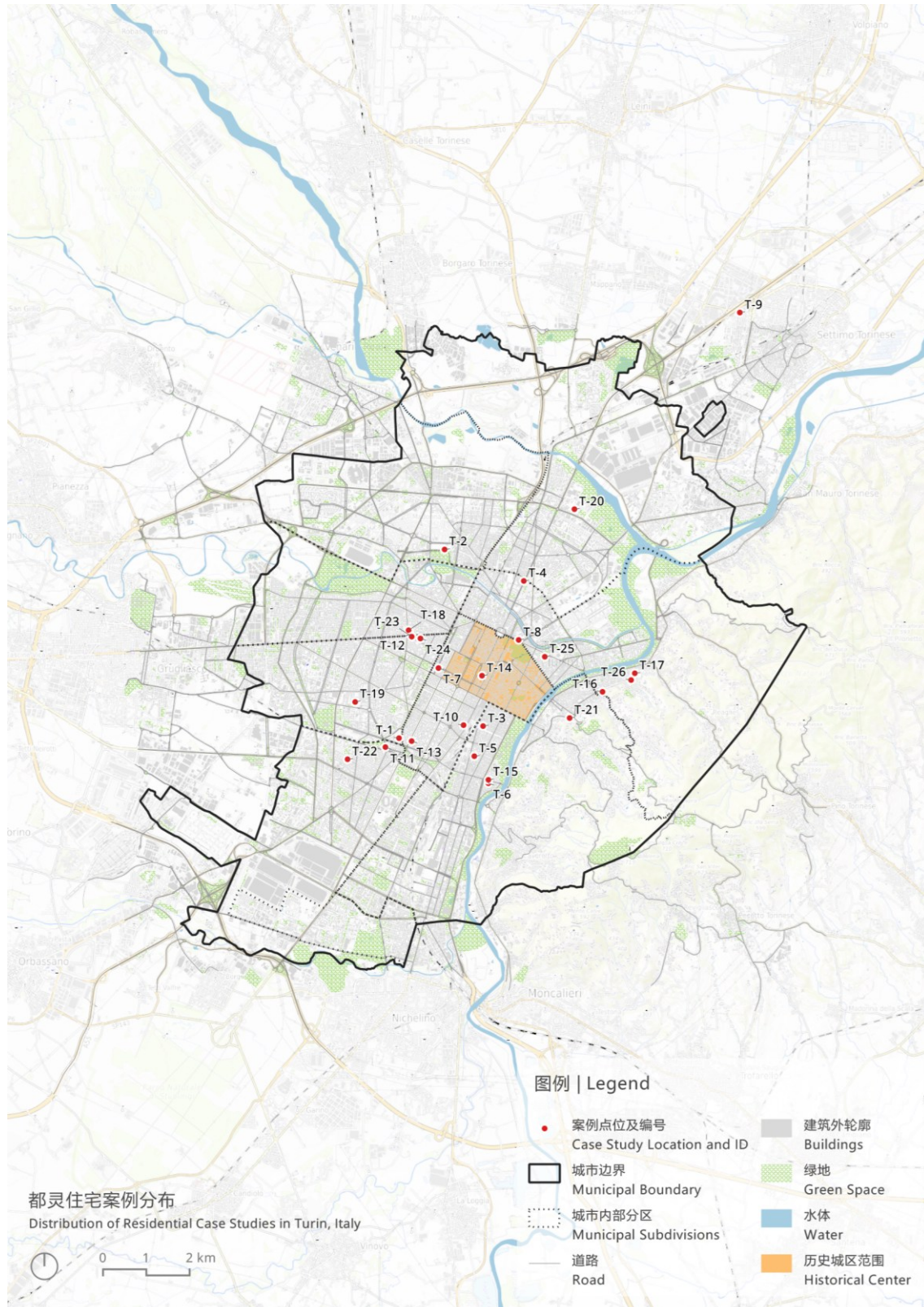


Figure 3.7 Distribution of residential projects in Turin (Source: self-drawn)

3.3.2 Data Analysis by Unit Dimension

In the collection, two-bedroom flats accounted for over half (88 units, or 54.0%), followed by one-bedroom flats (including studio flats) (45 units, or 27.6%), with three-bedroom flats in third place (27 units, or 16.6%), and only three four-bedroom flats. When calculated inclusive of the total balcony area, the median unit size was 103.2 m². The median sizes for one-, two-, three- and four-bedroom units were 65.2 m², 113.3 m², 153.8 m² and 199.0 m² respectively. The vast majority of units featured a balcony (160 units, or 98.8%), with only two units lacking one. In terms of the number of units per layout type, single-balcony units predominate (102 units / 63.0%), followed by double-balcony units (55 units / 34.0%), with three triple-balcony units.

3.4 Summary of this chapter

This chapter begins with an overview of the general situation regarding recent residential construction in Italy. A sample set was established using a 5% sampling method, comprising 96 projects, corresponding to 162 units and 221 balconies. Subsequently, a coding system comprising three dimensions—project, unit and balcony—was developed using a typological approach, resulting in a total of 33 codes. Finally, statistical analysis was conducted on the codes using statistical methods. Statistics for the project dimension reveal that projects are primarily located in modern built-up areas, with construction methods dominated by reconstruction or renovation; site scales range from entire blocks to sub-plots within blocks, encompassing both single-building and multi-building clusters, with significant variations in size; building heights are predominantly between 4 and 11 storeys; and while market-sector housing predominates, social housing and mixed-use housing types are also represented. Statistical analysis of the unit layout dimension revealed that the number of rooms was predominantly one or two; the median unit area, calculated inclusive and exclusive of balcony space respectively, was 103.2 m² and 84.9 m²; the vast majority of units featured balconies, with 1–2 being the most common; the median proportion of balcony area was approximately 21%, exhibiting variations across cities and housing types, with Rome generally having a higher proportion. Statistics regarding balconies reveal that recessed or mixed configurations are predominant. The median width and depth of balconies are 6.0 m and 2.0 m respectively; width varies more significantly than depth, with the width-

to-depth ratio predominantly falling within the moderate range of 1.0–4.0. The above multi-dimensional statistical analysis outlines the basic characteristics of the case study projects, units and balconies. The following two chapters will explore these from the perspectives of habitation and urban planning respectively, further summarising balcony characteristics and design strategies.

Chapter 4 Balcony Characteristics and Design Strategies: Residential Perspective

In recent years, there has been a shift in Italian residential philosophy towards a greater emphasis on semi-outdoor lifestyles. The lockdowns imposed during the pandemic have led people to re-evaluate the importance of a healthy living environment, whilst the increasingly evident trend of global warming has brought the concept of sustainability into sharp focus. How will this comprehensive shift in residential philosophy, lifestyle and climate conditions affect multi-unit housing? What characteristics do the balconies in such developments exhibit, and how can design strategies be employed to respond to these changes? This chapter will analyse data from a case study collection from a residential perspective and, drawing on literature reviewing the evolution of residential philosophies, interpret the balcony characteristics revealed by the data. Finally, based on typical case studies, it will outline design strategies for balconies from a residential perspective.

4.1 Balcony Data Analysis from a Residential Perspective

Based on multi-dimensional data coding of the case study collection, data relating to residential use—such as the number and dimensions of balconies, functional configurations, greenery planting and shading facilities—has been extracted. The coding involves balcony greenery types and shading types (project dimension); the number of balconies, area ratios and spatial relationships (unit type dimension); and balcony width, depth, functional types and furniture types (balcony dimension).

4.1.1 Quantity and Dimensions

The data reveals that the vast majority of units are equipped with balconies (160 units, or 98.8%), with only two units lacking a balcony. Among these, single-balcony unit types account for 63.0%, whilst double- or triple-balcony unit types account for 35.8%. This indicates that the balcony has evolved from a discretionary option to an indispensable default feature within unit layouts.

Compared to historical examples, the floor plan dimensions of existing residential balconies in Italy have increased, characterised by wide frontages and moderate depths. The median frontage is 6.0 m (interquartile range 4.0–9.4 m), and the median depth is 2.0

m (interquartile range 1.7–2.6 m). the median total internal balcony area is 20.0 m² (interquartile range 12.2–32.9 m²), and the median proportion of balcony area is 21.1% (interquartile range 12.9%–29.0%), establishing the balcony as a key element influencing the spatial organisation of the unit floor plan, rather than merely a peripheral ancillary space.

A cross-analysis with the cities where the projects are located reveals certain differences in balcony area ratios between cities, with Rome's balcony area ratio being significantly higher than that of the other two cities. The reason for this lies in market regulation resulting from differences in the methods used to calculate saleable floor area across regions: in Rome, protruding balconies are calculated at 25%, recessed balconies at 35% and enclosed balconies at 60%, whilst in Milan, similar to Turin, protruding balconies are calculated at 50% and recessed balconies at two-thirds. Rome's lower conversion ratios mitigate the increase in saleable area resulting from large balconies, thereby incentivising an expansion of balcony space to some extent.

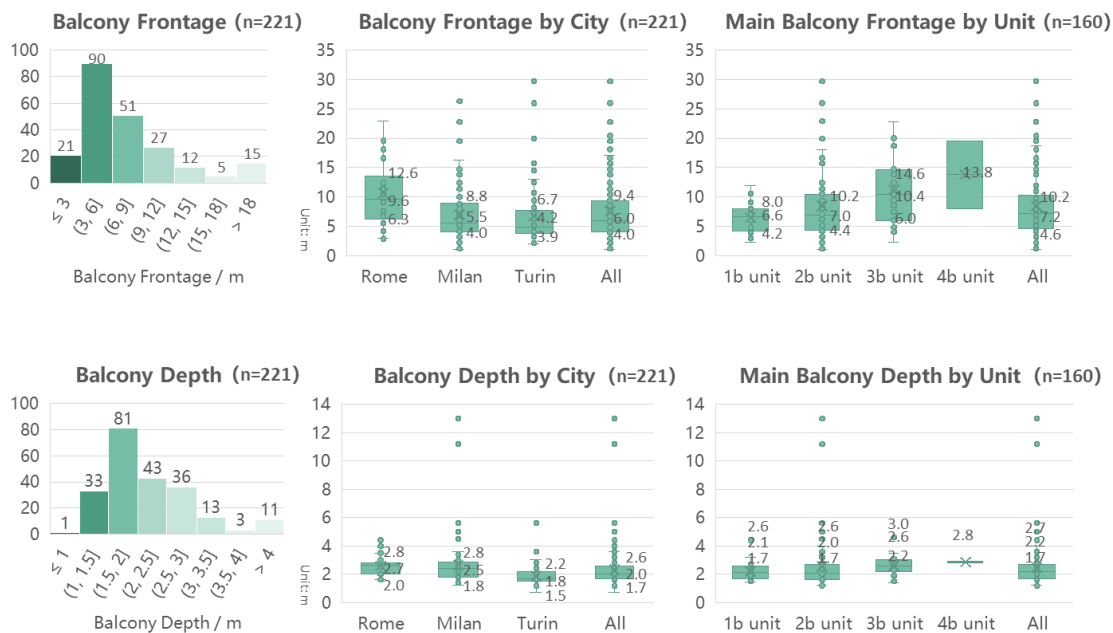


Figure 4.1 Balcony Dimension Analysis

4.1.2 Function and Furniture

Field research has revealed that balconies in Italian homes primarily serve functions such as gardening, housework, storage and leisure. Balcony furniture comprises two categories: lightweight items such as tables and chairs, and fixed fixtures. Data shows

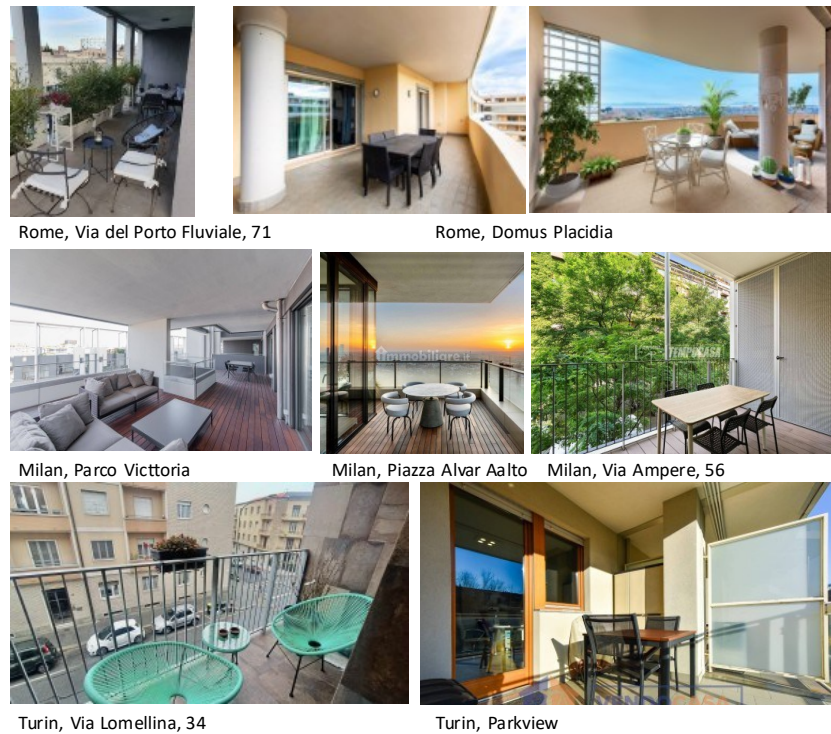


Figure 4.2 Real-life photos of balcony furniture in use

(Source: <https://www.immobiliare.it/>, <https://www.idealista.it/>)

that, in addition to the primary function of gardening, the vast majority of balconies serve a leisure function (192 / 86.9%), whilst half are used for housework such as laundry and drying clothes (112 / 50.7%). some serve storage purposes (36 units / 16.3%), whilst a small number are used for dining and socialising. The statistics reveal that a single balcony often fulfils multiple functions.

In 61.1% of units, furniture is placed on the balcony; amongst these, lightweight, movable leisure items such as loungers, tables and chairs account for the largest proportion, reaching 97.0%, which aligns with the characteristic that balconies predominantly serve as spaces for leisure and relaxation; Furthermore, a small number of balconies are fitted with fixed furniture such as sofas, built-in dining units and worktops, which can be used for dining and socialising when the weather permits; these features are found exclusively in cases involving larger balconies.

4.1.3 Landscaping and Planting

Field research revealed that balcony landscaping can be categorised into two types: self-initiated planting and centrally managed planting. The latter category includes planting facilities such as movable planters, fixed flower beds and planting troughs. Data shows that the vast majority of developments feature self-initiated balcony landscaping

(92 out of 100, or 95.8%), typically in the form of potted plants placed on the floor or hanging baskets attached to railings, reflecting residents' long-standing tradition of enjoying gardening. Some projects (15 out of 156, or 15.6%) implement centrally managed greening, with property management responsible for maintenance and plant replacement. Of these: 9 projects feature movable planters positioned outside the balustrades, providing an effective visual display; whilst 6 projects incorporate fixed flower beds, planting troughs and large planters designed to complement the building's architecture.

4.1.4 Shading Facilities

Due to the intense sunlight in Italy, and to enhance summer comfort on balconies and indoors, more than half of the projects (52/54.2%) have installed one or more types of balcony shading facilities, including: fixed screening types (decorative panels, perforated panels and grilles, etc.), flexible retractable types (fabric awnings), adjustable component types (louvres and movable track panels) and vegetative shading types. The data shows that fixed screening systems were the most widely used (32 projects / 56.2%), followed by flexible retractable systems (17 projects / 29.8%), whilst adjustable systems (6 projects / 10.5%) and vegetative shading (2 projects / 3.5%) were less common.

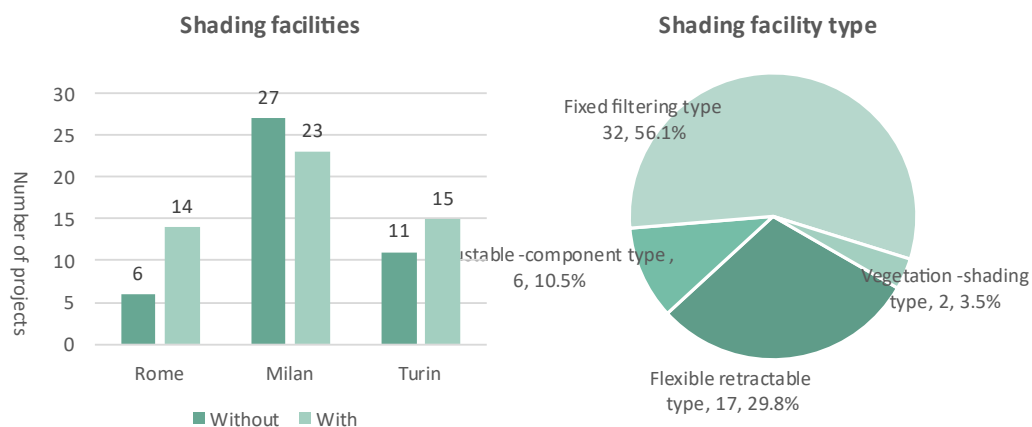


Figure 4.3 Application of a balcony shading system (Source: Self-drawn)

4.2 Balcony Design Characteristics from a Residential Perspective

Based on the results of data analysis regarding the number, dimensions, function, furniture, landscaping, planting and shading facilities of balconies, this study analyses their design characteristics in conjunction with literature on residential concepts.

4.2.1 Expanded Functions Responding to the Spillover of Residential Activities

Data indicates that the provision of residential balconies has become standard practice, with an increase in the floor area of balconies, a shift in their function towards leisure, and, in multi-balcony unit layouts, a differentiation of functions between main and secondary balconies alongside refined storage design. This reflects a recent trend in Italian residential philosophy: the semi-outdoor lifestyle facilitated by balconies is once again being prioritised, and the role of balconies in enhancing residential quality is being re-evaluated. Compared with historical examples, recent residential balconies do indeed exhibit characteristics such as an increase in the number of balconies, greater depth, larger floor areas and multifunctionality.



Historical cases

Top | Juliet's House, Verona (begun in the 13th century)
 Down | Palazzo Venezia, Rome (begun in 1455)



Recent projects

Top | Monti della Breccia residential project in Rome (2021)
 Bottom Left | La Corte Verde residential project in Milan (2013)
 Bottom Right | Parkview residential project in Turin (2021)

Figure 4.4 A comparison of residential balcony examples from ancient times to the present (Source: <https://casa-di-giulietta.it/>, <https://www.cityzeum.com>)

This trend towards transformation has become increasingly evident in the wake of the COVID-19 pandemic. Following the outbreak of the COVID-19 pandemic in 2020, Italy imposed a nationwide lockdown, confining residents to their homes for extended periods and rendering traditional public spaces such as streets and squares temporarily inoperative. Against this backdrop, residents took to their balconies, responding to one another through song, musical instruments and even the clanging of pots and pans. Spontaneous collective activities, epitomised by these ‘balcony concerts’, were widely documented by the media, rapidly propelling the balcony into the spotlight of public attention. During home isolation, daily life was confined to the interior of the home, whilst

the balcony, situated at the transitional point between inside and outside, private and public, became a ‘temporary public space’ where residents could see others and be seen by others through ‘contactless socialising’, thereby engaging in genuine interaction. The pandemic thus highlighted the balcony’s unique spatial attributes as a space straddling the interior and exterior, as well as its special value in alleviating mental stress.

At the same time, the shift to working from home—which emerged during the emergency response to the pandemic—has gradually become the norm. As the functions of the home have become increasingly multifaceted and the time spent at home has lengthened, the impact of housing quality on overall quality of life has been amplified. Research indicates that over half of young people aged 18–34 recognise the feasibility of remote working from home; the majority of Italians no longer view the home merely as a basic living container for a few functions such as sleeping, but rather as a multifunctional space that accommodates a variety of activities including living, working, socialising and learning ^[69]. As the daily activities carried out within the home continue to increase, residents’ demands for spatial flexibility, environmental comfort and quality of life have risen significantly; consequently, the value of the balcony—as a semi-outdoor space for lingering, transitioning and recharging—has also increased.

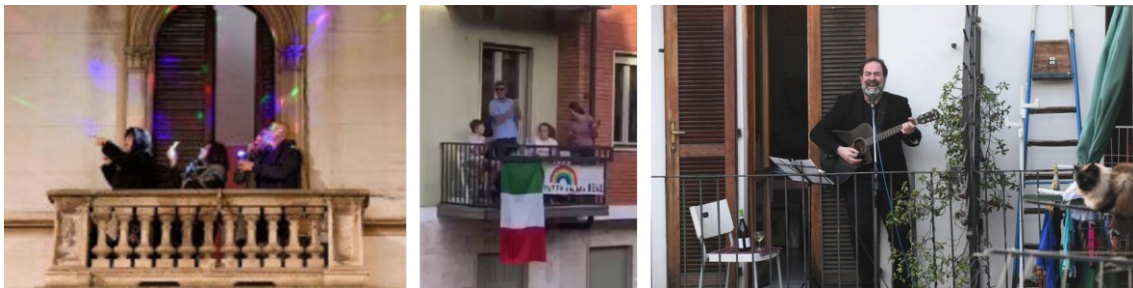


Figure 4.5 Balcony concerts during the pandemic (Source: www.domusweb.it, www.lastampa.it)

The ongoing discussions across Italian society regarding the value of balconies in the post-pandemic era have further crystallised a social consensus on their role in enhancing physical and mental well-being and the quality of living. On the one hand, from a mental health perspective, prolonged confinement at home can easily induce environmental stress and psychological fatigue; stepping out onto the balcony to feel the breeze and temperature changes, interact with green plants, and gaze out over the city can provide psychological relief from the confines of the home, reducing feelings of helplessness and oppression^[70]. On the other hand, from a physical health perspective, the open nature of balconies provides greater opportunities for natural light and

ventilation ^[71]. Several surveys have also shown that Italian residents have placed greater emphasis on healthy living conditions since the pandemic, making the value of balconies even more prominent. A report from the property sector ^[69] notes that over half of respondents indicated a greater focus on residential health features, such as indoor air quality, following the pandemic; research by a major Italian bank on the pandemic's impact on housing preferences indicates a marked increase in residents' appreciation of outdoor spaces such as balconies^①; and a report by an Italian property firm highlights that the provision of additional outdoor spaces—such as balconies or gardens—that can serve as 'buffer zones' has become one of the key trends in future residential development. ^②

Driven by this trend, the case studies demonstrate an expansion of balcony functions to accommodate the spillover of domestic activities, which can be summarised into the following three specific design strategies: firstly, the main balcony is expanded to serve as a space for relaxation, socialising and dining; secondly, a partitioned utility balcony fulfils the basic function of drying laundry; and thirdly, the concealed storage design prevents clutter from spoiling the appearance.

4.2.2 Emphasising Greenery to Fulfil the Longing for an Idyllic Lifestyle

Data shows that planting greenery remains one of the primary functions of balconies. In recent years, there have been innovative explorations in collective management approaches and planting facilities, reflecting Italian residents' longing for a green, natural and idyllic lifestyle.

High-density living has now become the norm in major Italian cities. Against this backdrop, people increasingly wish to reintroduce pastoral experiences—such as nature, sunlight and greenery—into their limited living spaces, thereby enhancing the comfort of daily life. In response to this residential philosophy, and guided by the principles of 'sustainable development' and 'biophilic design', contemporary Italian architects such as Stefano Boeri and Luciano Pia have begun exploring the integration of greenery into the overall design of residential buildings. On the one hand, this responds to residents' aspirations for a pastoral lifestyle, improves the indoor environment, and creates a living experience akin to being in a forest within a high-density urban setting; on the other hand, by utilising richer and more extensive vegetation populations to sequester carbon,

① Banca d'Italia. QEF 627/2021[EB/OL]. [2026-03-15]. https://www.bancaditalia.it/pubblicazioni/qef/2021-0627/QEF_627_21.pdf.

② Gabetti Group. Gabetti CS sentiment 2020[EB/OL]. [2026-03-15]. https://www.gabettigroup.com/wp-content/uploads/legacy/Portals/0/Gabetti_CS_sentiment%202020.pdf.

increase oxygen levels, mitigate the urban heat island effect and enhance biodiversity, they make a positive contribution to the city's overall ecological environment.

Driven by this trend, the forms of balcony greening in these case studies have become increasingly diverse and can be summarised into the following three specific design strategies: firstly, increasing the proportion of greenery to expand green space; secondly, innovating forms to provide spatial conditions; and thirdly, integrating the façade to enrich planting forms.

4.2.3 Carefully designed solutions to meet climate buffering needs

Data shows that more than half of all projects incorporate shading facilities on balconies to mitigate the adverse effects of excessive summer sunlight, reflecting a trend in Italian residential design towards prioritising the climate-buffering function of balconies.

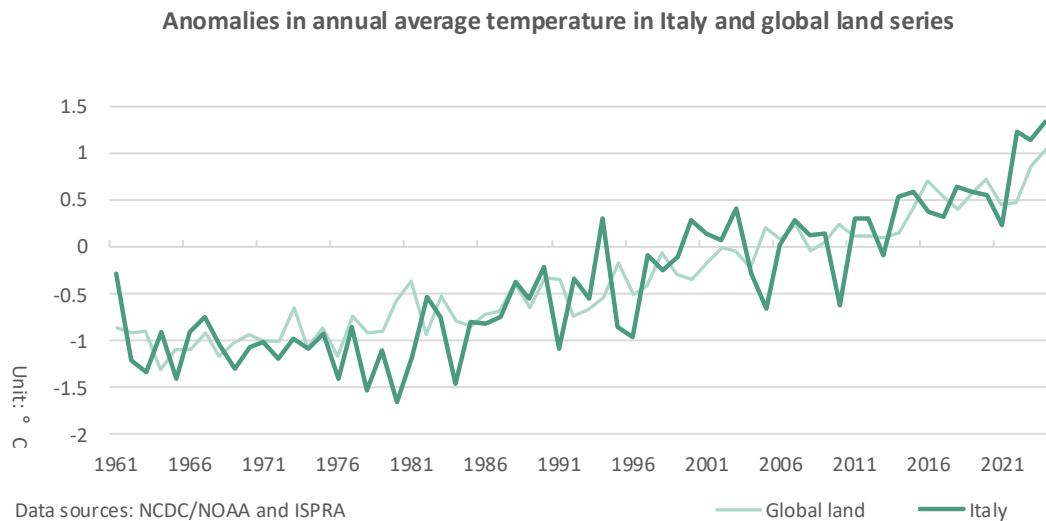


Figure 4.6 Anomalies in annual average temperature in Italy and global land series (Source: redrawn based on data from <https://www.cmcc.it/>)

Located in Southern Europe, Italy enjoys a generally mild climate. In recent years, however, influenced by the trend of global warming, the national average temperature has continued to rise, with heatwave issues becoming increasingly prominent in major cities. Data indicates that in 2024, Italy's national average temperature was 1.33°C higher than the 1991–2020 climate average, exceeding the global land-based average temperature increase (1.03°C) ^①. At the city level, compared with the 1981–2010 climate norm,

^① Data source: ISPRA. Temperatura media[DB/OL]. [2026-03-15]. <https://indicatoriambientali.isprambiente.it/it/clima/temperatura-media>.

temperatures in Rome, Milan and Turin have all risen significantly, by 2.7°C, 2.5°C and 2.1°C respectively, ranking first, second and fourth among Italy's provincial capitals in terms of the magnitude of the increase. At the same time, the hot season has noticeably lengthened. Taking 2022 as an example, the number of summer days (days with a maximum temperature exceeding 25°C) increased by 54 days in Rome, 57 days in Milan and 49 days in Turin, indicating a significant extension in the duration of hot weather^①. Against the backdrop of rising global greenhouse gas concentrations, this trend is set to continue in the future. According to forecasts by the Italian Centre for Mediterranean Climate Change (CMCC), under a high-emission scenario (RCP8.5), Italy's national average temperature is projected to rise by approximately 5°C by 2100 compared to 2000^②.

Driven by this trend, the range of approaches to using balconies as climate buffers has continued to expand, and can be summarised into the following three specific design strategies: firstly, optimising balcony depth to suit urban climatic characteristics; secondly, adopting recessed or hybrid configurations to enhance shading and ventilation performance; and thirdly, creating a second skin for balconies to mitigate summer overheating.

4.3 Function Strategies

Based on data analysis and feature analysis of the number of balconies, floor plan dimensions, functional types and furniture types, specific design strategies for functional layout are illustrated through case studies.

4.3.1 The main balcony serves as a space for relaxation, socialising and dining

Compared to enclosed indoor spaces, balconies offer the advantages of good natural light and ventilation, as well as unobstructed views. With the growing emphasis on semi-outdoor lifestyles, balconies are increasingly taking on more functions related to rest, entertainment and activities, becoming 'multi-functional rooms' that accommodate the spillover of residential functions. Traditional single-step balconies, due to their limited

① Data source: Istat. Temperatura e precipitazione nei comuni capoluogo di provincia: anno 2022, serie storica 2006-2022[DB/OL]. [2026-03-15]. <https://www.istat.it/tavole-di-dati/temperatura-e-precipitazione-nei-comuni-capoluogo-di-provincia-anno-2022-serie-storica-2006-2022/>.

② Data source: CMCC. Executive summary: climate risk in Italy[R/OL]. [2026-03-15]. https://www.cmcc.it/wp-content/uploads/2020/09/en_EXECUTIVE_SUMMARY_CMCC_climate_RISK_in_ITALY.pdf.

depth, make it difficult to arrange tables and chairs and are not conducive to prolonged stays; however, in recent residential designs, some projects have begun to furnish balconies with dining tables, loungers, sofas and coffee tables to support their role in leisure and social gatherings; and some spacious balconies even incorporate kitchen worktops integrated with balustrades and built-in cupboards along side walls, enabling them to serve as extensions of outdoor kitchens and dining areas during suitable seasons. Balconies represent a new lifestyle trend and enhance residential comfort; their spatial ambience and practical benefits have become key selling points that developers actively cultivate and repeatedly emphasise.



Figure 4.7 Real estate ads use balcony photos as a selling point (Source: <https://www.studiotransit.com>, <https://fronteparco.com>, <https://www.camedilizia.it/>, <https://www.scandurrastudio.com/>)

4.3.2 A partitioned utility balcony fulfils the basic function of drying laundry

Data indicates that units featuring two or three balconies account for 35.8% of residential units. Through a cross-analysis of the spatial relationships and functions of multi-balcony layouts, combined with field research, it has been found that configuring balconies with different orientations allows for a functional differentiation between primary and secondary balconies, with those facing the interior of the block primarily serving auxiliary functions such as drying laundry. As many Italian localities ^{[72][73][74]}

prohibit the hanging of laundry and the storage of miscellaneous items on street-facing balconies based on the principle of ‘urban decorum’ (decoro urbano), these functions have been transferred to auxiliary balconies facing the interior of the block.

Unlike the ceiling-mounted clothes rails commonly found in Chinese homes, Italian residents tend to use floor-standing, foldable drying racks that sit below the balcony railings, thereby avoiding visual disruption. When drying large items such as quilts and carpets, clotheslines are often strung along the outer edge of the balcony, which inevitably extends beyond the balcony’s boundaries.



Figure 4.8 Case study of main and auxiliary balconies (Source: Self-drawn)



Figure 4.9 Common low-position drying methods (Source: Self-taken photo)

4.3.3 The concealed storage design prevents clutter from spoiling the appearance

Data shows that 16.7% of units feature built-in cupboard storage on the balcony, with a median storage area of 1.37 m². This space is used to store cleaning tools such as cloths, mops and vacuum cleaners, as well as larger miscellaneous items. In some smaller units, balcony storage cupboards are even used to house washing machines. These storage spaces are positioned perpendicular to the width of the balcony and integrated into side walls or recesses, thereby minimising the visual impact of exposed items on the building's façade.

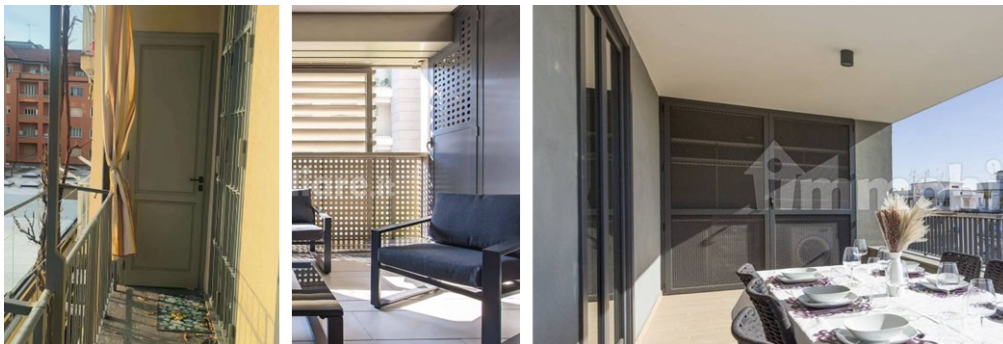


Figure 4.10 Common balcony storage solutions (Source: Self-taken photo, <https://www.immobiliare.it/>)

4.4 Greenery Strategies

Based on data analysis and a breakdown of the characteristics of balcony greening, this section will illustrate specific design strategies for planting, using case studies.

4.4.1 Increase the proportion of greenery to expand green space

Data indicates that the median balcony area within units is 20.0 m² (interquartile range: 12.2–32.9 m²), whilst the median proportion of balcony area is 21.1% (interquartile range: 12.9%–29.0%). Larger balconies provide the fundamental conditions for a greater variety of planting arrangements, and are more conducive to the creation of green spaces and the formation of relatively complete semi-outdoor living areas.

4.4.2 Innovate forms to provide spatial conditions

Italian residents have a long-standing tradition of balcony greening, with 95.8% of projects featuring plantings. Residents are accustomed to placing potted plants on the balcony floor or hanging flower baskets from the railings. Although this approach is adaptable, flexible and convenient, it poses a risk of objects falling from height. Furthermore, it is often constrained by the depth and height of the balcony, limiting the

range of plants that can be grown and making it difficult to achieve significant ecological benefits. By innovating the combination of facade and balcony forms—such as creating split-level or even multi-level balconies—tall balcony spaces can be formed capable of accommodating small to medium-sized trees and shrubs, thereby enhancing the effectiveness of balcony greening.

4.4.3 Integrate the façade to enrich planting forms

In recent years, some projects have gone a step further by integrating greening containers—such as movable planters, fixed planting troughs, planting pools and pots—with the balcony design. This explores ways of combining ‘vertical greening’ with the residential façade, responding to residents’ longing for a pastoral lifestyle.

(1) Planting Box System

The planting box system strikes an excellent balance between landscaping benefits and overall costs. Unlike spontaneous planting by residents, projects employing this system typically position the boxes outside the parapet, with management handled centrally by the property management team. By using boxes of the same colour and size, combined with pre-selected plant combinations, a consistent and predictable aesthetic is achieved. The property management team can also make flexible changes and adjustments in line with the seasons. Due to the limited size of the planters and the modest volume of soil they contain, they are best suited to relatively small plants.

The residential development at Via Marco Polo, 3 in Milan employs such a planter system. Designed by Arassociati and completed in 2021, this 11-storey building features a U-shaped form that opens towards the east. The north and south wings are set back in terraces, gradually reducing to four or two storeys, thereby enclosing a central communal green courtyard. In this building, uniform dark grey planters are primarily situated on the recessed sections of the north and south wings, positioned beyond the grey metal railings and matching the colour of the building’s main façade. Horizontal white beam-like decorative lines are obscured by the hanging greenery, enriching the expression of horizontal lines. Mid-air, the lush vegetation not only enhances the view from the interior, but also serves to shield the building from the curious gaze of passers-by looking up, forming a benevolent green screen.

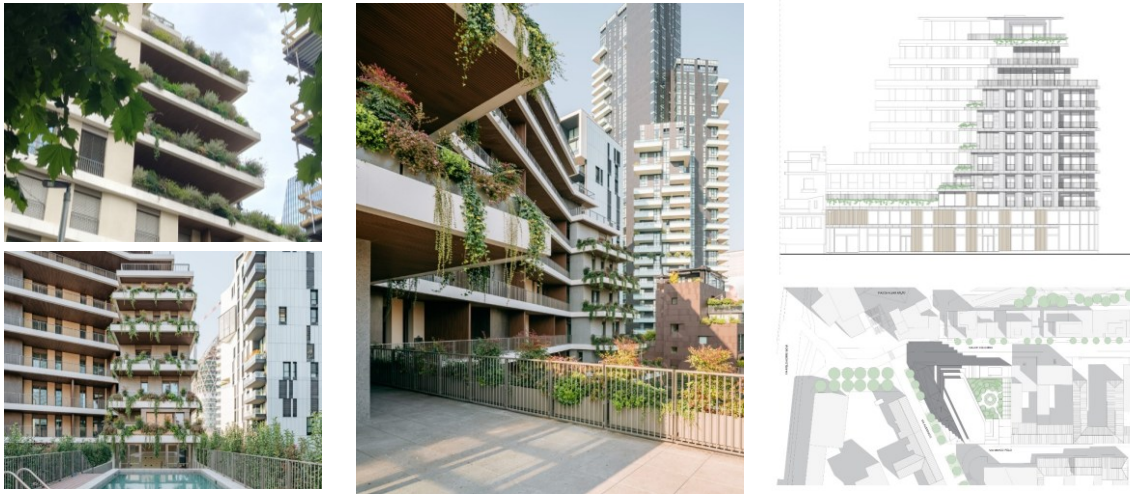


Figure 4.11 Milan Via Marco Polo, Planter box usage in Project 3 (Source: Self-taken photo, <https://arassociati.it/>)

(2) Planting Trough Systems

Compared to planting boxes, planting trough systems integrate the greening system more deeply with the building structure. These systems typically feature troughs of a fixed depth extending beyond the balcony parapets, creating a clean, continuous visual effect of greenery. They hold slightly more soil than planting boxes but offer slightly less flexibility.

The Monti della Breccia residential project, located on the outskirts of Rome, utilised a planting trough system on the balconies of some of its buildings, integrating ‘greenery as both an architectural and bioclimatic element’. Designed by Studio Transit and completed in 2021, this residential project comprises 12 buildings accommodating approximately 700 households. Upon completion, it was awarded the 2021 RÈGULA Prize for Best Italian Residential Project. By employing diverse façade materials and a rich architectural vocabulary, the development has created an iconic identity for each individual building.



Figure 4.12 The Monti della Breccia project in Rome (Source: <https://www.theplan.it/>)

(3) Vertical Garden Systems

Vertical garden systems are epitomised by the Bosco Verticale project in Milan. This building is regarded as a landmark example of vertical greening in architecture. Its core objective is to enhance biodiversity, focus on the relationship between humans and nature, and between humans and other species, whilst reflecting on the phenomenon of urban sprawl and land consumption. The architects envisioned the building itself as a tree, a ‘home for trees and birds, whilst also accommodating humans’.

Designed by Stefano Boeri Studio and completed in 2014, the complex is situated in the Porta Nuova urban regeneration area of Milan. It comprises two residential towers, 76 metres and 110 metres high respectively, arranged diagonally opposite one another. At the time of completion, it was one of the most expensive residential developments in Milan. On the 3-metre-deep cantilevered balconies along the facades of these two towers, 800 trees, 4,500 shrubs and 15,000 herbaceous plants have been planted. These were cultivated and studied by specialist botanists from 2010 onwards, distributed according to height and sunlight requirements, whilst also taking into account the impact of seasonal changes in the plants on the facade.

In the Vertical Forest project, the balconies are staggered, with their distribution and dimensions determined by the anticipated size of the plant canopies; the spacing between them can reach up to three storeys. Each balcony is outlined by white lines at the base,

creating a contrast with the dark grey building mass. The upper sections of the balconies are clad in an alternating pattern of dark grey and white panels, which to some extent mitigates the sense of heaviness and creates an architectural image dominated by short, horizontal lines, providing a understated architectural backdrop for the abundant plant life. The planting beds for trees on the balconies measure 1.1m deep by 1.1m wide; whilst those for shrubs and herbaceous plants measure at least 0.5m in depth and width. Their bases are lined with bituminous waterproofing membranes, with a protective layer preventing plant roots from penetrating.

Owing to its innovative exploration of integrating plants with architecture, this building was awarded the 2014 International High-Rise Award in the year of its completion and the 2015 CTBUH Global Award. Subsequently, this architectural typology took root in various locations across Europe and China, with the ‘Vertical Forest’ becoming a much-discussed architectural phenomenon both within and outside the industry, even indirectly influencing the concept of China’s ‘Fourth Generation Housing’. Rather than focusing on the gimmicky concept of ‘planting trees on a façade’, greater attention should be paid to the specific technical construction of the Milan ‘Vertical Forest’ project—particularly the integration of greenery with balconies—and the meticulous care



Figure 4.13 Milan Bosco Verticale (Source: <https://www.stefanoboeriarchitetti.net/>)

taken in plant selection, whilst also fully considering local climatic adaptability during practical implementation.



Figure 4.15 Actual view and structural details of the balcony in Bosco Verticale, Milan
(Source: same as above)

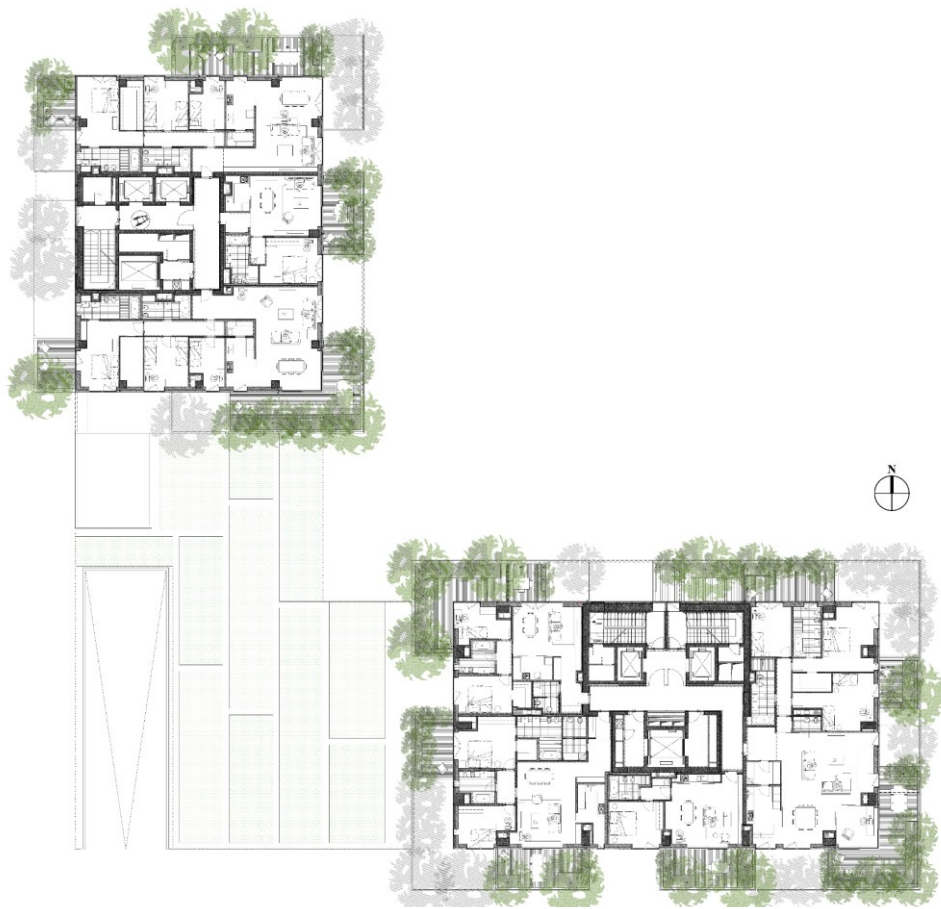


Figure 4.14 Standard Floor Plan in Bosco Verticale, Milan (Source: same as above)

The residential project at Via del Porto Fluviale 71 in Rome seamlessly combines centrally managed fixed planting beds with small potted plants tended by the residents themselves. Designed by Bruno Moauro and completed in 2017, the building comprises seven storeys. Within its grid-like, fully-balconied façade that emphasises horizontal lines, each unit enjoys a section of a gallery-style balcony, where residents can utilise the space within the metal railings for gardening activities. The centrally managed, deep-grey, large planting beds are situated outside the railings, extending over two storeys and planted with large shrubs or small trees, creating a rhythmic pause in the uniform façade.

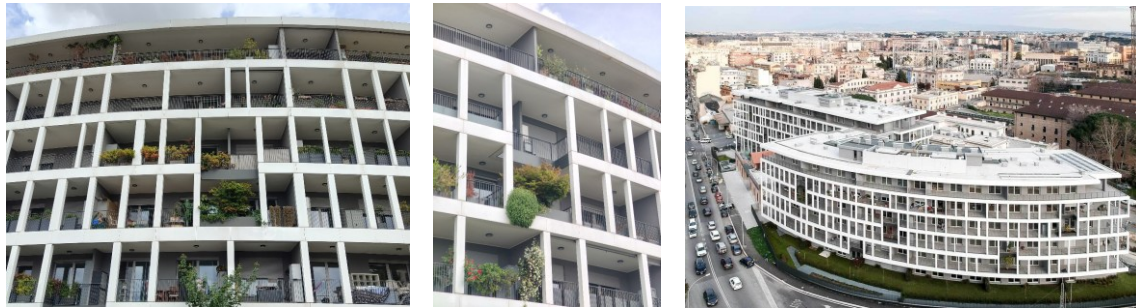


Figure 4.16 Balcony greenery at Project 71, Via del Porto Fluviale, Rome (Source: Self-taken photo, <https://www.nessimajocchi.it/>)

(4) Planting Pot System



Figure 4.17 Turin 25 Verde (Source: <https://www.archdaily.com/>)

The ‘25 Verde’ project in Turin, which employs a planting pot system, is situated at Via Gabriele Chiabrera, 25. Designed by Luciano Pia and completed in 2012, the six-storey building faces the street on its eastern, southern and western sides. The building forms a U-shaped enclosure along the street, with a lush urban forest at its centre.

The architect envisioned a green barrier both within and around the residential volume. The building’s interior and exterior interfaces consist largely of balconies, supported by tree-shaped weathering steel structures; some connect to the interior, whilst others house giant planters. In total, there are 150 trees and shrubs ranging in height from 2.5m to 8m, with the plant selection carefully considering diversity in species, foliage, colour and flowers. In summer, the dense foliage filters out excess sunlight; looking out from inside, one sees only the silhouettes of the plants. Stepping onto the balcony, one is enveloped by greenery, realising the concept of a ‘tree house’. Come winter, the leaves fall, allowing sunlight to penetrate this green barrier and warm the interior.

It is worth noting that resident interviews revealed that, due to the dense vegetation on the façade, the interiors are rather dim, necessitating the use of artificial lighting almost year-round. Some have also argued that the project’s appearance is too radical; the use of weathering steel gives it an overly industrial feel, making it seem like an alien object that fails to engage with the surrounding urban environment. This illustrates that when employing vertical greening, one must carefully consider the density of plantings, striking a balance between ecological benefits and indoor environmental quality, whilst ensuring harmony between the building and its surroundings.



Figure 4.18 Balcony in Turin 25 Verde (Source: <https://www.archdaily.com/>)



Figure 4.19 The interior of the 25 Verde is rather dimly lit (Source: Self-taken photo)

4.5 Detail Design Strategies

Based on data analysis and feature analysis of balcony depth, plan form and shading facilities, this section will illustrate specific design strategies for detailed design through case studies.

4.5.1 Optimise balcony depth to suit urban climatic characteristics

In the face of global warming, refined design of building envelopes helps to enhance the climate adaptability of residential buildings. Against this backdrop, the role of balconies as a climatic buffer has regained prominence. Data indicates that the median balcony depth is 2.0 m, with a quartile range of 1.7–2.6 m. Significant variations in balcony depth are observed across different cities; the main balconies in residential units in Rome and Milan are notably deeper than those in Turin, with median depths of 2.7 m, 2.5 m and 1.8 m respectively.

Overall, balcony depth remains at a moderate level, which not only enhances the flexibility of balcony functions and highlights their climate buffering role, but also avoids the adverse effects of excessive depth on indoor lighting and ventilation. The urban variations in balcony depth indicate that different cities regulate balcony dimensions according to local climatic characteristics. Among the three cities, Rome has a longer summer season, longer hours of sunshine, higher average temperatures, and a more southerly latitude with a slightly lower sun elevation angle; deeper balconies help to enhance shading and better fulfil the balcony's role as a climate buffer.

4.5.2 Adopt recessed or hybrid configurations to enhance shading and ventilation performance

In summer, recessed balconies can form a shading interface, reducing direct solar radiation entering the interior and lowering indoor heat gain; open-plan balconies help to facilitate natural ventilation, improve airflow and enhance indoor thermal comfort. In winter, provided the orientation and sunlight conditions are suitable, balconies can create a relatively mild microclimate in the areas near windows, providing a certain degree of thermal buffering for the interior. Relevant academic research also indicates that when balcony spaces are combined with strategies such as shading and ventilation, they can not only effectively mitigate summer overheating but also yield significant energy-saving benefits for summer cooling ^{[75][76]}.

Data indicates that most balconies adopt recessed or hybrid configurations, whereby part of the balcony is incorporated into the building's envelope and integrated with the main structure. Compared to cantilevered balconies, recessed configurations better balance shading and ventilation performance whilst retaining the semi-outdoor usage attributes.

4.5.3 Create a second skin for balconies to mitigate summer overheating

Data shows that more than half of the projects incorporate one or more types of balcony shading systems, with fixed shading systems being the most common, followed by retractable shading systems; adjustable shading systems and vegetated shading systems are less frequently used.

Fixed screening systems primarily refer to shading surfaces formed by fixed components, which achieve shading through two methods: blocking light via solid walls, decorative panels or frames, or reducing solar radiation via perforations, grilles or semi-transparent surfaces. A total of 32 projects utilised this approach. As a single project may incorporate multiple types of fixed components, there is some overlap in the counts for the following subcategories. Specifically, there are seven instances where solid walls are used (M-3, M-18, M-23, M-25, M-29, M-36, M-46), four instances where decorative panels or frames are used (R-10, M-4, M-38, M-47), 4 cases utilising perforated metal panels (R-2, R-10, R-16, M-5), and 12 cases utilising vertical louvre-type components (R-10, R-18, R-19, M-17, M-35, M-36, M-37, M-50, T-18, T-21, T-25, T-26), 6 cases utilising horizontal louvre-type components (R-7, R-10, R-18, T-9, T-15, T-16), and 4

cases utilising tinted or transparent fixed glazing (M-1, M-35, T-8, T-12). Fixed-filter types are typically non-adjustable; their shading performance is relatively stable and they integrate more effectively with the building façade; conversely, their seasonal adaptability is relatively weak, requiring a comprehensive assessment of factors such as balcony orientation and solar conditions during the design phase.

Flexible roll-up systems primarily refer to shading systems that form a shading interface using flexible materials such as fabric and are adjusted by rolling up or dropping down. A total of 17 projects utilised this type, all of which were roller blinds (R-5, R-8, R-9, R-11, R-12, R-14, R-20, M-25, M-26, M-28, M-34, M-36, M-37, T-1, T-2, T-4, T-20). This type of shading system is relatively lightweight in construction and can be designed and installed centrally prior to the completion of the residential building, or installed by residents themselves after completion following mutual agreement; it offers strong seasonal adaptability and adjustability, allowing it to be extended at different angles to form continuous shading surfaces of varying sizes when required, and retracted when not in use. The light transmittance of the fabric itself determines the effectiveness of sunlight filtering, as well as its impact on the external view from the balcony and the privacy within the balcony.

The adjustable component type primarily refers to shading systems that regulate solar radiation intensity through the opening, tilting, sliding or angular adjustment of components. A total of six projects utilised this approach, namely horizontal metal louvres (R-1), horizontal glass louvres (R-3), rotatable horizontal louver panels (R-10), overhead track-mounted shading panels (M-27), wooden louver roller blinds (M-2) and openable perforated metal panel doors (T-14). Compared to the flexible roll-up type, these systems are typically designed by architects to integrate with the building's façade, offering greater structural coherence and balancing adjustable solar control with the building's overall aesthetic. Among these, balcony shading systems utilising louver-style or panel-style components can be regarded as an extension of the external shutters and roller blind systems found in traditional Italian residences.

There are two projects employing vegetative shading systems, namely M-8 and T-6. In both cases, the exterior of the building façade is covered with a rich variety of trees and shrubs, creating a relatively dense green canopy between the balcony and the interior. Compared with the three systems mentioned above, the vegetated interface not only blocks solar radiation but also improves the microclimate through plant transpiration,

offering more comprehensive climate buffering benefits. At the same time, the vegetated interface serves to enrich the landscape experience and enhance the natural living environment.



Figure 4.20 Types of balcony shading facilities (Source: Adapted drawing)

4.6 Summary of this Chapter

This chapter adopts a residential perspective and, based on statistical analysis, summarises key features of balcony design, such as the expansion of functions to accommodate the spillover of residential activities, the emphasis on greenery to fulfil the desire for a pastoral lifestyle, and meticulous design to address climate buffering requirements. It also outlines design strategies across three aspects: functional layout, planting and landscaping, and detailing. Balconies are not only an extension of indoor residential activities but also a key component of the building façade, influencing the building's external appearance. Moving forward, the study will shift its perspective to examine balcony characteristics and design strategies from an urban perspective.

Chapter 5 Balcony Characteristics and Design Strategies: Urban Perspective

This chapter focuses on the unique positioning of the balcony as a key component of both residential façades and the urban interface. It analyses data from a collection of case studies from an urban perspective and examines design characteristics through a review of the literature on Italian urban policy regulations and residential management and maintenance models. Finally, it outlines design strategies for balconies from an urban perspective based on typical case studies.

5.1 Balcony Data Analysis from an Urban Perspective

Based on multi-dimensional data coding of the case study collection, data relating to the urban interface—such as balcony façade coverage, configuration, interface design, and management and maintenance—has been extracted. The coding includes balcony façade configuration types, sectional configuration types, degree of openness, and balustrade interface types (at the project level), as well as balcony façade coverage (at the unit level).

5.1.1 Facade Coverage

Balcony facade coverage refers to the proportion of the total balcony width relative to the total length of the unit's external light-receiving perimeter. The data indicates that balconies exhibit a high degree of coverage, with a median of 59.3% and a quartile range of 35.8%–100.0%. Further cross-analysis of coverage by city (Welch's $F(2, 98.081) = 23.555$, $p < 0.001$) revealed significant differences in balcony coverage between cities.

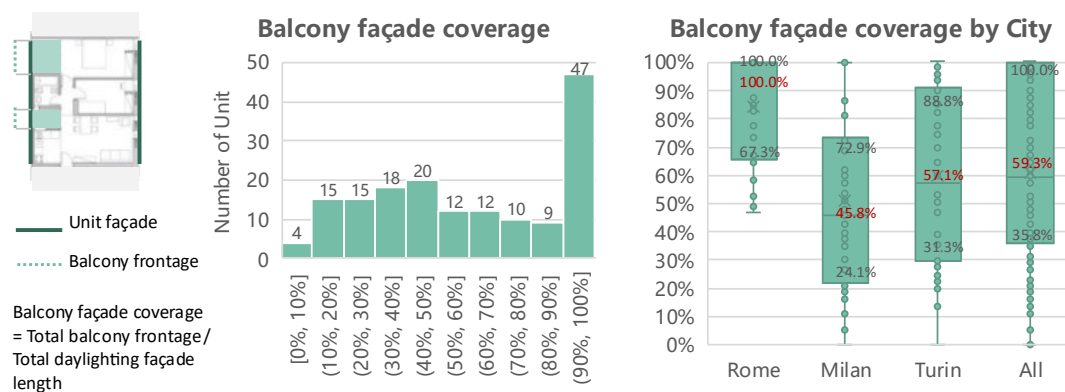


Figure 5.1 Balcony facade coverage Analysis (Source: self-drawn)

Balcony façade coverage in Rome was significantly higher than in Milan and Turin, with medians of 100.0%, 45.8% and 57.1% respectively. A cross-analysis of coverage and housing type (Welch's $F(2,159) = 14.685$, $p < 0.001$) revealed certain differences in balcony façade coverage between different housing types. Balcony façade coverage in market-sector housing and mixed-use housing was significantly higher than in social housing, with median values of 73.3%, 61.9% and 37.5% respectively.

5.1.2 Combination Patterns

Balcony façade combination forms were extracted from both cross-sections and elevations. Specifically: cross-sectional combination types included single-storey, split-level, multi-storey and terraced types, representing balconies of single-storey height, two-storey height, multi-storey height and those arranged in a stepped, staggered configuration, respectively; Elevation configuration types include independent, combined, staggered and gallery types, representing small-scale protruding balconies, vertically or horizontally connected balconies, horizontally staggered balconies and multiple balconies



Figure 5.2 Balcony facade combination types (Source: Modified drawing)



Figure 5.3 Balcony section combination types (Source: modified drawing)

connected horizontally, respectively. Data shows that the vast majority of sectional configurations are single-storey (89/92.7%), followed by terraced (5/5.2%), with only one instance each of split-level and multi-storey configurations. Among the façade configuration types, the combined type accounted for the highest proportion (48 cases / 50.0%), followed by the continuous corridor type (30 cases / 31.3%), whilst the staggered type (14 cases / 14.6%) and the independent type (4 cases / 4.1%) were less commonly used. The left-right combined and continuous corridor types within the combined category are collectively referred to as continuous balconies.

5.1.3 Interface Design

Balcony interface characteristics were extracted based on degree of openness and balustrade interface type, as follows: the degree of openness can be divided into three categories—open, enclosed and reversible glazing; balustrade interface types include opaque, semi-transparent and fully transparent. The data shows that the vast majority of projects feature open-type balconies (90/93.8%), with only a very small number adopting

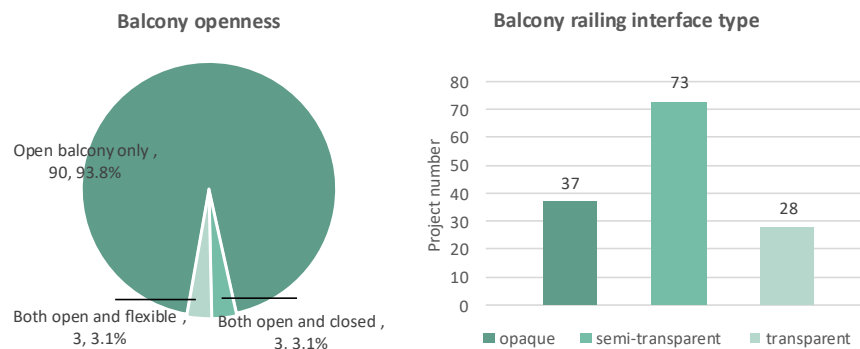


Figure 5.4 Balcony Openness Analysis (Source: Self-drawn)

the enclosed type. It is worth noting that three projects employed ‘removable transparent panoramic glass’ (VEPA) technology, installing reversible glazing on the balcony balustrades that can be closed during inclement weather, thereby enhancing living quality and energy performance whilst preserving the original façade appearance as much as possible. Further analysis of balcony balustrade interface types revealed that 41.7% of projects utilised a design approach combining two or three balustrade types; consequently, these were aggregated in the statistical analysis. The data indicates that semi-transparent balustrade interfaces were the most common (73 projects / 76.0%), followed by opaque (solid balustrades) (37 projects / 38.5%), with fully transparent (transparent glass balustrades) being the least common (28 projects / 29.2%). Materials used for semi-transparent balustrades included translucent glass, tinted glass, perforated metal panels and metal railings.

5.1.4 Management and Maintenance

Data indicates that 30% of projects utilise flexible, retractable shading facilities such as sun blinds on balconies, the majority of which were retrofitted. Based on on-site observations, the use of sun blinds of the same colour, material and style across a single building block helps to maintain a unified and harmonious building façade. In addition, 15.6% of projects implement centralised management of greenery, with property management responsible for maintenance, irrigation and plant replacement, thereby ensuring the long-term effectiveness of balcony landscaping.

5.2 Balcony Design Characteristics from an Urban Perspective

The design characteristics of balconies were analysed by examining data on façade coverage, configuration, interface design and management and maintenance, combined with a review of the literature on residential concepts and policy regulations.

5.2.1 Balconies as Key Elements in Shaping Facades and Responding to the Environment

Data indicates that the median facade coverage of residential balconies reaches 59.3%, and diverse explorations have been undertaken regarding their arrangement in both sectional and elevational contexts. This demonstrates that balconies have become a key element in shaping facades and influencing the architectural image.

In the urban tradition of Italy, residential buildings function as the cells of the city, enclosing blocks to form a continuous urban interface and defining the morphological boundaries of streets and squares. The Italian school of urban morphology, represented by figures such as Muratori and Aldo Rossi, emphasises that buildings are the fundamental units of urban morphological evolution, and that architectural design should respond to historical stratification, urban texture and site-specific spatial relationships. Consequently, as the most numerous and widely distributed ‘ordinary buildings’ in the city, the façades of residential buildings not only represent the image of the individual structure but also play a vital role in revealing internal structures, connecting with the surrounding environment, maintaining the continuity of the urban interface, and shaping positive external spaces.

Against this conceptual backdrop, the balconies featured in this case study not only contribute to the shaping of the façade but also respond to the site’s environment to create positive external spaces. These can be summarised into the following five specific design strategies: Firstly, using balconies to create gaps that highlight the layered relationship of extensions; Second, using balconies to echo surrounding architectural elements, embodying a dialogue between old and new; third, differentiating between street and courtyard levels to create a varied façade; fourth, positioning balconies at street corners to reinforce visual identity; and fifth, employing gallery-style balconies to introduce expansive views.

5.2.2 Balcony Interfaces Reflect the Dual Demands of Individual Use and Overall Harmony

Data indicates that 76.0% of projects employ semi-transparent balustrade interfaces. Field research and resident interviews reveal that semi-transparent balustrades offer a greater sense of security than fully transparent interfaces, whilst providing a lighter feel than solid ones. They address residents’ need for privacy whilst embodying the modern aesthetic of the residential design. This design feature is also closely linked to the multifunctional nature of the balcony and the emphasis on greenery. Semi-transparent balustrades can moderately conceal furniture, laundry and clutter whilst ensuring natural light and visual permeability, and allowing greenery to be displayed to the outside.

This characteristic demonstrates that balconies not only reflect the individual needs of the residents within the dwelling but also embody the city’s requirements for the

overall harmony of residential facades. Against this conceptual backdrop, the design strategies adopted for the balconies in the case studies can be summarised into the following four categories: firstly, exploring reversible glazing technology to meet flexible enclosure requirements; secondly, using semi-transparent balustrade materials to balance privacy and display; thirdly, combining different types of materials to adapt to diverse usage scenarios; and fourthly, from a holistic perspective, installing lightweight partition walls between units.

5.2.3 The Long-Term Quality of Balconies Depends on Collective Governance

Data indicates that in certain projects, the installation of uniform sunblinds and other ancillary facilities ensures façade harmony, whilst balcony greening is subject to unified management. These experiences in collective governance help to guarantee the long-term living quality and façade image of residential buildings. This is inextricably linked to three aspects: Italy's strict management of architectural façade aesthetics, the meticulous categorisation of building extensions, and the neighbourhood-based collaborative management of residential blocks.

Firstly, at the urban level, the façades of residential buildings in Italian cities (particularly those facing the street) are governed by the principle of 'urban decorum' (*decoro urbano*), which aims to preserve the aesthetic integrity and recognisability of the built environment. Although individual residents hold title to their detached homes, any alterations to the façade or other externally visible elements must, in principle, not detract from the overall appearance of the building or the character of the urban streetscape. In other words, the building's overall appearance is regarded as a public objective that requires collective maintenance by the residential community.

Secondly, following the post-war expansion of large-scale housing construction, residential development in Italy has, on the whole, entered a phase of 'stock renewal' centred on the maintenance, restoration and renovation of existing housing. To enhance the living environment through this renewal whilst preventing disorderly alterations from damaging the building's appearance and public safety, Italy has incorporated interventions of varying intensity—ranging from interior refurbishment to demolition and reconstruction—into a unified framework for the management of building activities. It implements tiered controls by matching different permit procedures to the type of

intervention. Depending on the elements involved and the intensity of the intervention, building activities (*interventi edilizi*) are classified into several types ^[77], such as: ‘extraordinary maintenance and renovation’ (*interventi di manutenzione straordinaria*), which allows for the replacement of certain building components; however, if changes to the building’s volume, height or floor area are involved, this falls under ‘building renovation’ (*interventi di ristrutturazione edilizia*). Based on the classification of building works, the owner must apply for the corresponding permit ^[78], whereby high-intensity interventions such as rebuilding or demolition and reconstruction generally require a building permit (*permesso di costruire*), whilst less intensive interventions involving the structure or façade often require a SCIA (certified notification of commencement of works, *segnalazione certificata di inizio attività*); other interventions not involving the external façade or structure, and primarily concerning interior refurbishment, are subject to a CILA (certified notification of commencement of works, *comunicazione di inizio lavori asseverata*). Consequently, through this tiered licensing system, residential renovation and refurbishment are subject to regulation by urban planning tools, building management regulations and relevant specialised standards at all levels.

At the same time, Italy has established a closed-loop accountability system comprising ‘professional endorsement, administrative supervision and liability tracing’ by strengthening the review responsibilities of qualified professionals and moderately streamlining approval processes. Taking CILA as an example, application documents must be prepared and signed by a ‘qualified professional’ (*tecnico abilitato*) to certify the project’s compliance, with management reinforced through ex-post spot checks and liability tracing.

The synergistic effect of the aforementioned tiered permitting system and professional accountability mechanism has strengthened the management of residential renewal. When interventions affect the external façade, structure or overall form, projects often require more stringent application documentation, a certain approval cycle and corresponding professional service costs. This objectively curbs arbitrary alterations and unauthorised construction, thereby reducing the negative impact of disorderly renovations on the appearance of buildings and public safety.

Thirdly, the day-to-day operation and maintenance of Italian apartment blocks relies on cooperation and collective governance among owners and neighbours. Relevant legislation, building upon the Civil Code, further clarifies the scope of common areas and

the rules governing them ^[79]. The facades of residential buildings (le facciate) are classified as common areas; consequently, their maintenance, renovation and alterations require discussion and decision-making involving all owners. This implies that whilst homeowners naturally enjoy the right of use within their own units, when their actions spill over to affect the safety or overall appearance of the common areas, consultation among all homeowners is required. This co-governance framework provides a coordination mechanism for various management matters in multi-unit residential buildings. By incorporating façades into the common areas, responsibilities and authorities for the day-to-day maintenance of the façade's appearance are clarified, and individual interests are prevented from undermining the building's overall image.

Against this conceptual backdrop and within the framework of policy regulations, the design strategies for ensuring the long-term quality of centralised balconies in this case study can be summarised into the following three categories: firstly, standardising the installation of attached fixtures to ensure a unified and harmonious façade; secondly, clarifying maintenance responsibilities based on the attributes of structural components; and thirdly, integrating greening technology systems to establish a unified management and maintenance mechanism.

5.3 Environmental Response Strategies

Based on data analysis and feature analysis of balcony façade coverage and configuration methods, this section will illustrate specific design strategies for environmental response through case studies. The following five subsections will explore the following aspects: the expression of extension relationships, the interplay with surrounding elements, the organisation of interface layers, the enhancement of node identification, and the integration of landscape resources.

5.3.1 Use balconies to create gaps that highlight the layered relationship of extensions

Data indicates that 20.8% of projects employ a 'retention and conversion' approach, whereby spatial expansion or functional conversion is achieved through vertical extensions, horizontal additions or partial refurbishment whilst retaining part of the original building's volume, thereby maintaining spatial scale and street frontage. In extension projects, it is essential to clearly define and express the relationship between

the new volume and the existing structure. If handled improperly, the new volume can easily clash with the existing one, both diminishing the recognisability of the old building and making the new section appear jarring. Creating ‘gaps’ through the use of balconies is an effective approach: as voids, balconies can create separation between the new and old volumes through variations in projection and recess, generating shadows and negative space. This transforms the relationship between old and new into a recognisable layered composition, thereby clearly presenting the new volume whilst maintaining overall harmony.

The project at Via Saluzzo 84 in Turin employs a distinct strategy of vertical stratification: the lower volume consists primarily of solid walls, presenting a heavy and stable appearance that maintains the solidity of the street frontage; the upper volume, by contrast, is clearly set back and features a gallery-style balcony. The balconies form a clear transitional zone between the old and new volumes: the lower volume remains intact, maintaining the street frontage, whilst the upper extensions imply its added nature through its set-back position and open façade, creating a distinct layered relationship.

The project at 16 Viale Monte Grappa, Milan, similarly reinforces the vertical layering of old and new through the use of balconies. The lower volume is relatively solid, with a symmetrical layout of projecting balconies reinforcing the order of the façade; the upper volume, meanwhile, features large areas of glass set back from the building line, with gallery-style balconies. These gallery-style balconies act as a gap, separating the light, transparent new section above from the heavier, more solid existing volume below, clearly highlighting the differences between the old and new sections in terms of materials, the relationship between projections and recesses, and the language of the façade. This gap allows the existing and new volumes to be interconnected whilst maintaining their individual legibility.



Figure 5.6 (Left) Turin, Via Saluzzo, 84; (Right) Milan, Viale Monte Grappa, 16 (Source: <https://www.incantiere.me/>, self-taken photo)

The Residenze Carlo Erba project in Milan uses balconies to facilitate a dialogue between the new and existing volumes in both horizontal and vertical directions. The existing building is solid, whilst the base of the new extension, which connects horizontally to it, features recessed balconies and predominantly solid walls, ensuring harmony between the two in terms of the rhythm of their interfaces and their scale. Building on this, a ‘gap’ formed by a gallery-style balcony on the ground floor separates the new and old volumes vertically. The level of this ‘gap’ is set back from the eaves of the original building, reflecting a modest approach to the new structure’s integration into the existing environment, whilst also ensuring a smoother and more natural transition between the different forms. The upper storeys of the new section feature a frame-style façade, which, combined with the recessed and projecting balconies, creates a more open and airy visual expression.



Figure 5.5 Milan Residenze Carlo Erba (Source: <https://eisenmanarchitects.com/>, self-taken photo)

5.3.2 Use balconies to echo surrounding architectural elements, embodying a dialogue between old and new

Data shows that 82.3% of projects are located in modern urban built-up areas, whilst 20.8% of project sites are of the terraced or infill type. As a facet of the façade vocabulary, the balcony serves as a key means of establishing a connection with existing buildings in the vicinity. New interventions can respond specifically to surrounding architectural elements through the scale, surface characteristics and rhythmic distribution of the balconies, thereby creating a contemporary expression within the continuous street frontage that is both harmonious and distinctive, reflecting the dialogue between old and new architecture.

The Domus Eleganza project in Milan was originally a small office building situated on a street corner. In response to the differing heights of the street walls on either side, a projecting glass volume is situated at the corner to bridge and harmonise the interfaces of varying heights. This allows the building to maintain the continuity of the street wall whilst enhancing the recognisability of the corner node. Simultaneously, this projecting transparent volume signals the building's renewed character in a lighter, more open manner, embodying distinct contemporary characteristics. In terms of façade detailing, the balcony serves as a key medium connecting the old and the new. Responses are tailored to the distinct existing façade characteristics of the two streets: on one side, the installation of point-like balconies mimics the building's frontage, depth, rhythm and material vocabulary, echoing the rhythm of balconies in the surrounding buildings; on the other side, external metal rod elements on the balconies correspond with the linear metal features on the adjacent building's façade. By establishing a legible dialogue between different buildings through the balconies, the project anchors itself within the surrounding neighbourhood context.



Figure 5.7 Domus Eleganza, Milan (Source: Self-taken photo, <http://bemaa.it/it/>)

5.3.3 Differentiate between street and courtyard levels to create a varied façade

Data indicates that 63.5% of residential project sites consist primarily of subdivided plots within blocks. This suggests that recent residential construction has, to a large extent, continued the traditional block-style housing prototype, with façades exhibiting a clear dichotomy between street-facing and courtyard-facing elements. The street façade serves as the visible boundary within the city, emphasising orderliness; however, due to the impact of traffic noise and pedestrian flow, it is relatively enclosed. In contrast, the courtyard façade faces the interior of the block, possesses a semi-public character, emphasises a domestic atmosphere, and is comparatively more open. Based on this overall positioning, the balconies on these two types of façades exhibit distinct differences: street-facing balconies tend to be narrower, whilst courtyard-facing balconies are wider, often forming a continuous balcony façade.

The site of the project at Via Piranesi 44 in Milan was formerly the office building of a biopharmaceutical company, with the southern side adjacent to a railway line. During the renovation, the design retained the dual-layered structure of the street and courtyard,

with three buildings forming a U-shaped enclosure to create a green courtyard opening towards the south. The street-facing façade is dominated by solid stone walls, with windows and recessed balconies kept to a minimum; whereas the courtyard facades feature continuous, sinuous balconies. The white balcony slabs create distinct horizontal lines, with vertical wooden louvres installed between storeys to enrich the rhythm of the facade whilst further enhancing privacy.



Figure 5.8 Milan, Via Piranesi, 44 (Source: <https://www.mabarquitectura.com/>)

The Spazio Flaminio project is situated adjacent to a heritage conservation area. As the neighbourhood was established some time ago and the site comprises an underutilised urban plot flanked by streets on both sides, the new residential development must harmonise with its surroundings in terms of scale and façade treatment. Consequently, a dual-layered façade approach was adopted: the street-facing façade, predominantly clad in stone, is relatively closed, with horizontal metal mouldings aligning with the scale and rhythm of neighbouring buildings; the courtyard-facing façade features continuous balconies and vertical wooden louvres, creating an open and airy yet private appearance.



Figure 5.9 Rome's Spazio Flaminio (Source: <https://www.studiotransit.com/>)

5.3.4 Position balconies at street corners to reinforce visual identity

In the facades of block-style residential buildings, in addition to the dual layers of the street and the inner courtyard, street corners are often given special attention. Corners serve as key nodes where sightlines converge, fulfilling functions of spatial transition, directional guidance, and site identification. Placing balconies at street corners allows residents to take advantage of the expansive views characteristic of these locations, offering diverse vantage points and a unique spatial experience. Additionally, the interplay of light and shadow created by recessed and projecting balconies reinforces the corner's role as a visual anchor, helping pedestrians identify street intersections and turns.

Based on an analysis of the relative positioning of the balcony's outline, corner balconies can be configured to either recess inward or project outward. In the case of Via Lomellina 43 in Turin, a deep, double-height recessed balcony on the third floor has become a landmark of the neighborhood. In contrast, the case of 61 Corso Giacomo Matteotti in Turin features an L-shaped, projecting balcony volume at the corner. The contrast between the transparent balcony facade and the surrounding buildings enhances the corner's visual impact, reflecting the architectural style of the era.

Based on an analysis of balcony plan shapes, corner balconies can adopt either a “round exterior, square interior” or a “square exterior, round interior” configuration. The project at 67 Corso Giulio Cesare in Turin features a corner balcony with a curved exterior façade; the repetitive rhythm of the curves softens the massing and enhances the rhythm of the façade. The project at Via Marco Polo 3 in Milan, situated at a sharp road bend,



Figure 5.10 Turin, C.so Giulio Cesare, 67 (left); Milan, Via Marco Polo, 3 (right) (Source: Self-taken photo, <https://arassociati.it/>)

incorporates a corner balcony. By integrating the internal floor plan, the inner surface of the balcony is treated with a curved profile, while the outer surface remains at a right angle, creating a spatial buffer and transition. Both approaches contribute to visual continuity and permeability at street corners, and their formal logic echoes the corner

strategies employed in the Novocomum Apartments (see Figures 2–5), a representative work of 20th-century Rationalism.



Figure 5.11 Turin, Via Lomellina, 34 (left); Turin, Corso Giacomo Matteotti, 61 (right)
(Source: <http://www.piustudio.it/>, <https://due.to.it/>)

5.3.5 Employ gallery-style balconies to introduce expansive views

Data indicates that 31.3% of projects adopt a gallery-style balcony façade organization. When residential buildings face urban open spaces such as parks, riverbanks, or plazas, the horizontally extended building mass forms the enclosing boundary of the space. Gallery-style balconies serve as a common spatial response: externally, they help create a horizontally continuous architectural image that echoes the expansive landscape; internally, they provide residents with viewing and gathering platforms, thereby integrating the external landscape into the daily living experience.

The Uptown Milano project in Milan combines both tower and slab building typologies. Taking advantage of the slab building's western orientation toward an open park and green space, the project features continuous gallery-style balconies, supplemented with facade elements such as metal louvers to mitigate direct sunlight, thereby balancing the needs for views and shade.



Figure 5.12 Uptown Milano, Milan (Source: Self-taken photo, <http://www.zanettidesign.it/>)

5.4 Interface Design Strategies

Balcony interfaces must not only respond to the diverse needs of residents across different seasons and situations but also contribute to the overall aesthetic of the residence. Based on data analysis and feature analysis of balcony openness and balustrade interface types, this section will illustrate specific design strategies for interface design through case studies.

5.4.1 Explore reversible glazing technology to meet flexible enclosure requirements

Data shows that the vast majority of projects feature only open balconies, while some include either open balconies or reversible enclosed balconies. This is because Italy's overall climate is relatively warm, and balconies are typically viewed as open spaces lacking a permanent, fully enclosed climate boundary. However, during actual occupancy, residents still have a certain need for enclosure. On the one hand, from the perspectives of climate and energy consumption, adding an enclosure helps shield against wind and rain, reduces heat loss in winter, enhances comfort, and lowers heating costs. On the other hand, given the relative scarcity of living space and the fact that balconies serve multiple

functions such as laundry drying and temporary workspaces, residents often seek to gain additional indoor usable area by enclosing their balconies.

Italian building codes classify enclosed balconies separately as “verandas,” and they are generally assigned a higher conversion ratio for floor area calculations than open balconies. Although converting an open balcony into a closed one is not difficult, it involves changes in floor area, building volume, and intended use. Therefore, in practice, it is often necessary to first verify local planning regulations and relevant technical standards and complete the corresponding application procedures before implementing a fixed enclosure, which typically involves a certain approval process and associated costs.

To address residents’ practical needs regarding “temporary enclosures, improved acoustics and energy efficiency, reduced heat loss, and partial rain protection,” Italy enacted a decree in 2022^[80] that classifies eligible VEPA (vetrate panoramiche a movibili totalmente trasparenti, or “removable transparent panoramic glazing”) as part of “free construction activities” (edilizia libera)^[81], which do not require a building permit. This means that, provided statutory conditions are met, VEPA technology can be used to enclose balconies without the need for a separate permit application, significantly reducing the time and approval costs associated with balcony enclosure.

It is important to emphasize that VEPA technology does not completely enclose the balcony; it is essentially a lightweight, reversible, and adjustable enclosure system. The regulations explicitly require: first, VEPA must be fully removable, must not use fixed vertical components, must not create a “stable enclosed space,” and must not result in changes to the building’s volume or floor area; second, the system must ensure natural micro-ventilation to maintain continuous airflow; third, it must be fully transparent, with construction and appearance designed to minimize visual impact and not compromise the building’s overall silhouette; finally, even as a form of free architectural expression, VEPA must comply with other regulations regarding fire safety, public health, and cultural landscape preservation. Specific technical details can be found in the UNI 11998:2025 standard for removable glass systems, which was promulgated and implemented in 2025^[82].

Among the case studies, three projects employ VEPA technology. In the Domus Placidia project, VEPA is extensively integrated into the continuous curved balcony facade, covering nearly half of its surface. In contrast, the two applications at Nuova Bonelli and Domus Tiburtina feature the installation of sunshades on the exterior of the VEPA system to balance the requirements for variable envelope systems and solar shading.



Figure 5.13 VEPA implementation results (Source: <https://www.domusplacidia.it/>, <https://www.camedilizia.it/>)

5.4.2 Use semi-transparent balustrade materials to balance privacy and display

Data shows that 76.0% of projects use semi-transparent balustrade materials, 38.5% use opaque balustrade materials, and 29.2% use fully transparent balustrade materials. The degree of transparency in balcony balustrade materials influences residents' perception of openness, privacy, and spatial security, and further affects the comfort of spending time on the balcony. Externally, it contributes to the organization of facade proportions and influences the perception of the building's image.

(1) Opaque Balustrade and Representative Cases

Opaque interfaces primarily include solid half-wall balustrades, as well as components such as solid walls and colonnades found in some continuous balconies. Such facades can partially block views from the street, particularly preventing pedestrians from looking up from below, thereby providing users inside the balcony with a greater sense of security, stability, and privacy. Especially for balconies on higher floors, solid

balustrades of a certain height can significantly reduce the dizziness associated with looking down. These solid components are also often combined with planters and other elements to enrich the balcony's visual experience. Conversely, their limitations are also evident: they partially obstruct views from the interior of the dwelling and weaken the visual continuity between the interior and the urban landscape. When a building faces an open landscape or requires enhanced natural light and transparency, solid facades often restrict the balcony's view and hinder natural lighting.

The Monticello Residences (Residenze Monticello) (R-8), a residential project near Vatican City in Rome, employs a balcony interface design that combines solid balustrades with planters. On the one hand, the placement of planters visually reduces the perceived height of the inner balustrades, alleviating the sense of oppression created by the solid interface; on the other hand, the lush vegetation creates a soft enclosure while also highlighting the project's iconic view—St. Peter's Basilica. At the same time, cabinets installed along the balcony railing allow the space to accommodate daily activities such as food preparation. During suitable seasons, residents can cook and dine while enjoying the cityscape.



Figure 5.14 Rome Residenze Monticello (Source: <https://monticellorome.com/>)

(2) Semi-Transparent Balustrade and Representative Examples

Semi-transparent facades are the most common type in this collection of case studies, primarily comprising materials such as metal railings, perforated metal panels, as well as translucent glass, frosted glass, gradient glass, and tinted glass. These facades fall between fully enclosed and fully open designs, allowing for a certain degree of visual penetration while providing necessary privacy. Dark metal railings have a visually light presence and offer relatively weak obstruction to external views, but variations can still be created by adjusting the density and angle of the railings. At the same time, due to their

relatively low cost, they are widely used. Materials such as perforated panels, frosted glass, and gradient glass can create richer layers of translucency, striking a good balance between openness and privacy. They serve both functional and aesthetic purposes, enhancing the facade's visual expression through variations in material, light transmission, and surface details.

Cino Zucchi Architetti has consistently explored the collage-like application of semi-transparent materials in numerous residential projects, driving a creative reinterpretation of 20th-century Milanese residential architecture and creating a highly

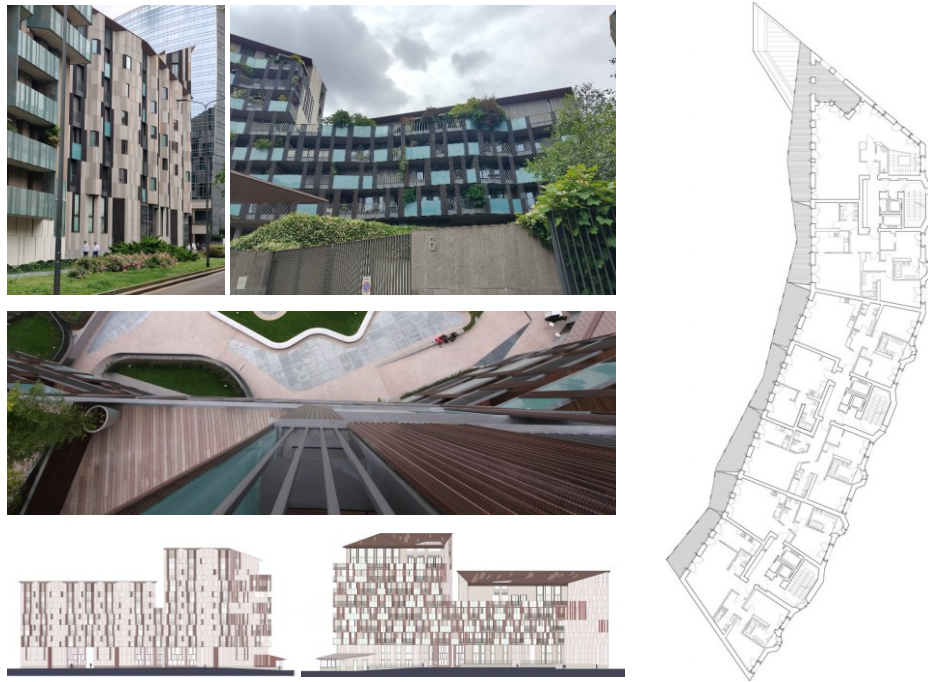


Figure 5.15 La Corte Verde, Milan (Source: Self-taken photo, <https://www.zucchiarchitetti.com/>)

recognizable contemporary identity for these homes. Take, for example, their “La Corte Verde” (M-5) project in Milan’s Porta Nuova district. Two continuous, slightly sinuous volumes extend along the northern and eastern sides of the site, enclosing a garden on the southwest side. This arrangement gives rise to two distinct facade characteristics: the street-facing facade is dominated by solid walls, emphasizing vertical segmentation; the garden-facing facade, on the other hand, features continuous balconies, emphasizing horizontal extension. The former is primarily composed of two types of beige stone with similar tones, laid in a mosaic pattern; the latter features an interwoven collage of gray metal railings, bright green frosted glass, and copper-red folded perforated full-height metal panels, creating a richly layered, semi-transparent interface.

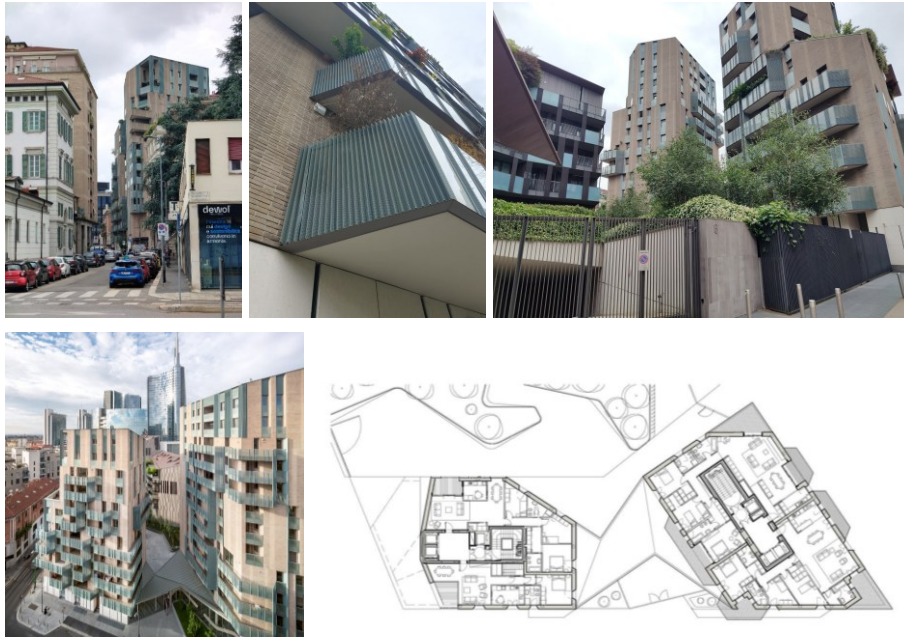


Figure 5.17 Novetredici Residential Complex, Milan (Source: Self-taken photo, <https://www.zucchiarchitetti.com/>)

The adjacent Novetredici Residential Complex (M-20) adopts a layout of two towers, one facing east and the other west. The main building volume uses two types of brick with similar hues, maintaining color harmony with the previous project. The balconies, however, enhance their distinctiveness through semi-transparent facades: floor-to-ceiling gray-green corrugated perforated aluminum panels are installed on the slanted sides, while the front features gray-green frosted glass and metal railings. The gray-yellow main building volume contrasts sharply with the gray-green balcony facades.



Figure 5.16 Milan, Via Valtorta, 32 (<https://www.zucchiarchitetti.com/>)

The firm's recently completed Via Valtorta 32 (M-43) in Milan forms a U-shaped enclosure that opens onto an internal garden: a four-story slab building is arranged along the street on the north and east sides, adjacent to historic buildings, while a ten-story tower is situated on the south side. The project continues the layered organization of semi-transparent facades. Metal railings are used on the slanted sides of the balconies to maintain transparency and lightness, while frosted glass is employed on the front to enhance screening and privacy. This creates two distinct levels of transparency within the same balcony volume, thereby refining the facade's expression and the user experience.

(3) Fully Transparent Balustrade and Representative Cases

Fully transparent balustrades, typified by all-glass balustrades, “erase” the balcony boundaries as much as possible, thereby maximizing visual continuity and establishing a more direct visual connection between the balcony and the external landscape. This approach is suitable for projects facing expansive views, urban vistas, or those requiring an enhanced sense of facade lightness. However, its drawbacks are equally evident: privacy is compromised, and occupants are more easily exposed to external views.

Precisely for this reason, in actual living situations, residents often add secondary screening to transparent interfaces—such as plants or hanging fabrics—to compensate for the lack of privacy in daily use. The Residenze Ailanthus (M-26) in Milan was converted from a former office building by adding a new floor and installing balconies on the south facade. The original design featured glass balustrades to emphasize the horizontal lines of the balcony floor.

Another design approach involves installing solid balustrades at the lower section of the balcony while using transparent glass or metal railings at the top to block views while optimizing the proportion of window openings on the facade and widening the field of view. This approach can be seen in the project at Via Alberto Pollio 75 (R-13) in Rome.



Figure 5.18 Milan Residenze Ailanthus (Source: Self-taken photo, <https://www.immobiliare.it/>)

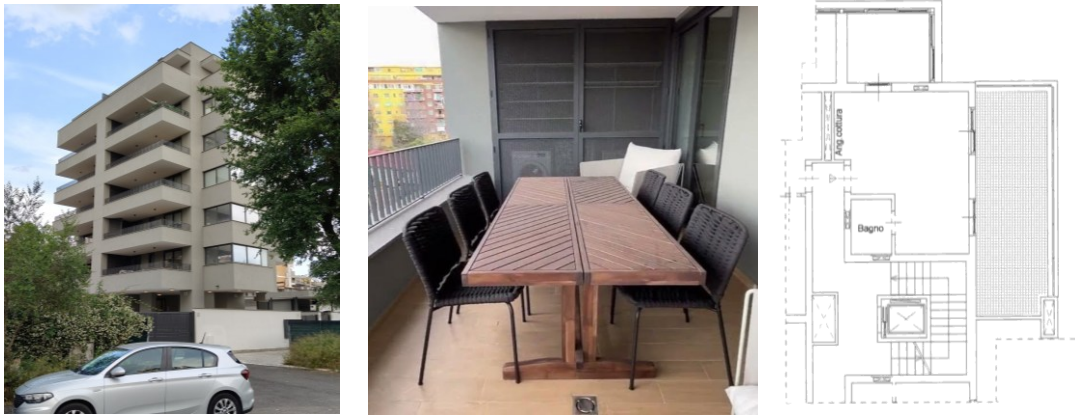


Figure 5.19 Rome, Via Alberto Pollio, 75 (Source: <https://www.immobiliare.it/>)

5.4.3 Combine different types of materials to adapt to diverse usage scenarios

In addition to interfaces with a single level of transparency, the case collection includes 40 examples that simultaneously employ two or more materials with different transparency properties, accounting for 41.7% of the total.

Some projects divide continuous balconies into distinct sections, with one part emphasizing enclosure and privacy while another enhances transparency and views, achieving a refined interface organization through differentiated composition. For example, the project at Via Andrea Salaino 10 in Milan (M-1) creates a rhythmic façade by alternating full-height tinted glass with metal railings; Similarly, the Citylife Residences (M-9) in Milan, designed by Zaha Hadid Architects, employs interfaces with varying degrees of transparency to further enhance the facade's streamlined composition. Compared to single-material solutions, composite facades are better able to respond flexibly to varying floor heights, different sections of the facade, and diverse functional requirements, thereby achieving a comprehensive balance between privacy, openness, and facade composition.



Figure 5.20 Milan Via Andrea Salaino, Project 10 (Top); Milan Citylife (Down) (Source: <https://acpvarchitects.com/>, <https://www.city-life.it/>)

5.4.4 Install lightweight partition walls between units from a holistic perspective

Data shows that 50.0% of projects adopt a combined layout for balcony facades, while 31.3% use a corridor-style layout; among these, 58 projects feature continuous balconies shared by two or more households on the same floor. As a facade design approach, continuous balconies can enhance the building's overall cohesion and sense of horizontal extension, but they also create new boundaries between residents on the same floor that require clear demarcation. If the boundaries between units on the balcony are

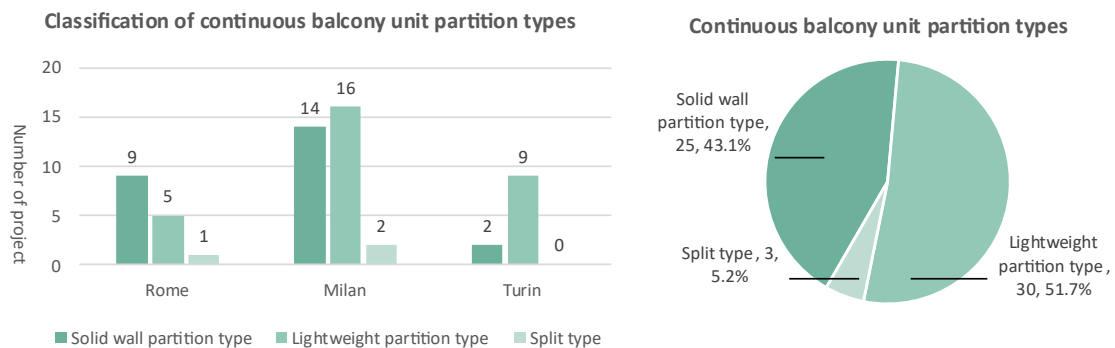


Figure 5.21 Unit Partition Types in Continuous Balcony (Source: Self-drawn)

not properly defined, not only will the responsibility for routine maintenance—such as cleaning and repainting—be unclear, but the costs associated with tracing liability and negotiating repairs for water leaks will also rise significantly. At the same time, continuous balconies may amplify visual and noise disturbances between adjacent residents, thereby triggering neighborhood conflicts.

Field research reveals that the inter-unit partitions of continuous balconies can be categorized into three types: solid-wall partitions, lightweight partitions, and detached partitions. Among these, lightweight partitions are the most common (30 cases, 51.7%), followed by solid-wall partitions (25 cases, 43.1%), with three cases of detached partitions. Different partitioning methods represent a comprehensive trade-off between boundary clarity and the integrity of the facade.

(1) Solid Wall Partition Type and Representative Cases

The solid-wall partition type typically uses floor-to-ceiling solid walls to clearly demarcate the boundaries between units. Its advantage lies in the fact that the boundaries of maintenance responsibilities between units are most clearly defined, and it provides a more direct barrier against visual and acoustic interference, helping to reduce disturbances between neighbors. Solid-wall partitioning can often be integrated with storage cabinets to enhance the practical value of balconies. A potential issue is that solid partitions can create a disjointed effect on a continuous facade; therefore, designers often integrate them with existing solid elements on the facade—such as colonnades, columns, or rhythmic grilles—to maintain the overall composition.

For example, at Via Maestri Campionesi 15 in Milan (M-3), the solid partition walls are embedded within a system of randomly distributed columns on the facade; similarly, at Casa Tersicore in Milan (M-23), the separation is achieved using the colonnade elements on the exterior of the balcony. At Via del Porto Fluviale 71 (R-5) in Rome, the

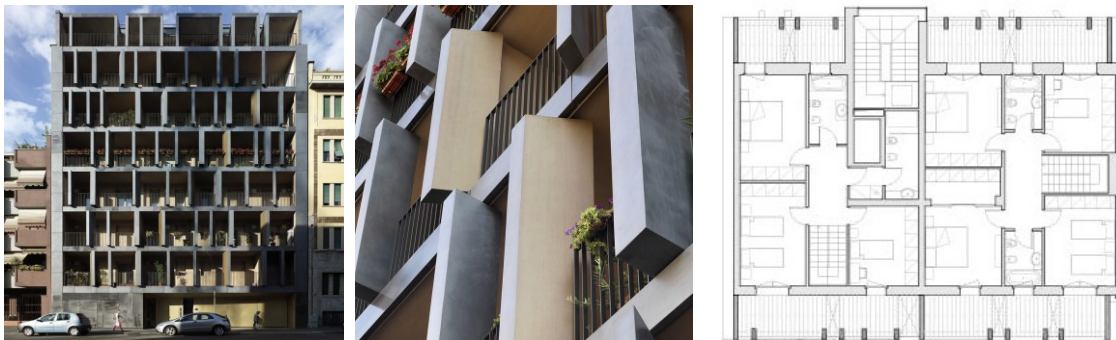


Figure 5.22 Milan, Via Maestri Campionesi, 15 (Source: <https://www.archea.it/>)

partition walls are positioned directly behind slender white columns and finished in a dark gray that matches the main structure, minimizing their visual presence on the façade as much as possible. At Uptown Milano (M-35) in Milan, a metal grille creates the primary rhythmic pattern of the facade, screening the unit partition walls, while the outer edges of the grille are beveled to further reduce their visual presence.



Figure 5.24 Rome, Via del Porto Fluviale, 71 (Source: Self-taken photo)



Figure 5.25 Uptown Milano, Milan (Source: Self-taken photo)

(2) Lightweight Partition Type and Representative Examples

Lightweight partition type typically use components such as metal panels that do not reach the ceiling, perforated panels, or translucent glass to define boundaries. Compared to solid walls, this type generally does not aim for full-height, fully enclosed partitioning; instead, it primarily serves to block sightlines and indicate boundaries, with relatively



Figure 5.26 The Citta del Sole project in Rome (Source: Self-taken photo, <https://www.labics.it/>)

limited sound insulation. However, their advantage lies in their minimal impact on the facade composition, making it easier to maintain the horizontal lines and sense of lightness of continuous balconies. At the same time, removable components offer greater flexibility in construction and future replacement, while also maintaining controllability in facade organization when unit boundaries vary across different floors. Therefore, the fact that lightweight partitioning accounts for the highest proportion in the sample may stem from its comprehensive balance between the overall facade effect and the feasibility of future operation and maintenance.

The mixed-use residential and commercial project “Città del Sole” (R-3) in Rome is built on the site of a former bus depot. The residential section employs horizontal glass



Figure 5.27 Piazza Lorenzo Bernini, Turin, 2 (Source: Self-taken photo, <http://www.piustudio.it/>)

louvers to emphasize the facade's horizontal character, while the unit boundaries utilize frosted glass that aligns with the louver grid to minimize their visual presence on the facade. The EUR Living (R-12) project in Rome employs continuous metal railings, with the unit partitions also utilizing frosted glass to reinforce the horizontal composition. The Piazza Lorenzo Bernini, 2 (T-12) project in Turin uses the building's walls to define the facade's planar composition. To avoid disrupting the continuity of the balconies' sloped roofs, metal partitions that do not reach the ceiling are used to demarcate individual units.



Figure 5.28 Rome EUR Living project (Source: Self-taken photo, <https://www.theplan.it/>)

(3) Disconnected Partition Type and Representative Cases

The Disconnected Partition Type is the least common. Its characteristic is to indicate unit boundaries—such as through ground-level breaks—while maintaining the continuity of the facade, thereby causing minimal disruption to the facade's overall integrity. The limitation of this approach lies in the relatively weak expression of boundaries; it requires careful control of issues such as sightlines and privacy at the break points, and often relies on soft elements like greenery to enhance visual separation and psychological screening.

For example, in the Cascina Merlata Social Village (M-15) in Milan, a high-rise social housing building designed by B22 Architects utilizes the continuous balconies on the southeast facade as a “screen” interface, with some floors employing the disjointed partition method to define unit boundaries.



Figure 5.29 Cascina Merlata Social Village (M-15) (Source: Self-taken photo, <https://www.archdaily.com/>)

In summary, each of the three partitioning methods has its own characteristics: solid walls clearly define property boundaries but require coordinated facade treatment; lightweight partitions provide only visual separation but offer flexible facade design; and staggered partitions maximize facade continuity but require attention to issues of mutual visibility and privacy. When using continuous balconies to demarcate unit boundaries, it is essential to comprehensively consider the overall facade effect and the full lifecycle of use and maintenance, minimizing mutual impact between neighbors to ensure harmonious relationships.

5.5 Long-term maintenance strategy

The long-term quality of residential facades and balconies depends, on the one hand, on strict control of architectural aesthetics, precise definitions of unauthorized additions, and collaborative neighborhood governance at the building level; on the other hand, it requires architects to fully consider the building's quality throughout its entire life cycle during the design phase. Based on data analysis and feature analysis of balcony management and maintenance, this section will illustrate specific design strategies for long-term quality assurance through case studies.

5.5.1 Standardise the installation of attached fixtures to ensure a unified and harmonious façade

In Italy, residential facades are subject to strict regulations. The installation of

additions such as sunshades cannot be decided freely by individual residents but is instead governed by both building-wide collective management and urban design regulations. If residents wish to install sunshades, they must obtain the consent of all building owners through consultation, establish uniform requirements regarding materials, colors, models, and construction methods, and receive approval from relevant municipal authorities^[83] before proceeding with unified installation.



Figure 5.30 The addition of sunshades to the balconies creates a rich yet unified architectural facade (Source: Self-taken photo).

Unlike most projects involving the retrofitting of sunshades, the project at Via Antegnati 7 (5 Square) in Milan incorporated cantilevered sunshades into the design process from the outset, providing the building complex with a unified and rich facade appearance. This social housing project was created by converting five vacant office buildings. During the renovation, the main street facades of the five buildings were unified to five stories, while retaining the original continuous balconies. External roller-shade systems were uniformly installed on the outer sides of the balconies, using fabric of the same color code. Through standardized installation heights, projection angles, and rhythmic control, the sunshades became “variable yet orderly” elements within a regular grid. These alternately arranged sunshades serve a dual purpose: they fulfill the technical functions of providing shade and controlling sunlight, while also contributing to the

facade's pattern and visual expression, thereby infusing the originally rigid facade with a more vibrant and dynamic character.



Figure 5.31 Milan 5 Square (Source: <https://5square.it/>)

5.5.2 Clarify maintenance responsibilities based on the attributes of structural components

Compared to indoor spaces, balcony components are constantly exposed to direct sunlight and rain in outdoor environments, making aging and staining inevitable during use. Common issues fall into two main categories: first, waterproofing and drainage problems, such as failure of the waterproofing layer, insufficient drainage slope, or clogged downspouts leading to water accumulation and backflow, as well as localized leaks caused by flower boxes or clotheslines. Such defects typically first damage the floor surface of the current-level balcony and then propagate downward, causing peeling and cracking of the ceiling on the balcony below. Over time, this may even lead to efflorescence and reinforcement corrosion. On the other hand, there are durability issues related to materials and components, such as loose metal fittings, delamination of finishes, and localized peeling.

Since these issues frequently extend across unit and floor boundaries, balcony maintenance often requires a clear division of responsibilities among neighbors. In Italy's apartment building management systems, maintenance responsibilities are defined based on the structural level of the components, the intended users, and whether they contribute

to the building's overall facade appearance. These responsibilities can generally be categorized into the following three scenarios:

1) In general cases, maintenance is primarily the responsibility of individual households^[84]. As an extension of the residential unit, the daily maintenance of the balcony is, in principle, the responsibility of the corresponding resident. This includes, for example, resurfacing, plastering and painting of the ceiling, localized waterproofing repairs, fixing loose balustrade components, and addressing localized damage caused by attached objects.

2) When issues involve adjacent interfaces between floors, responsibility is shared according to structural levels^[85]. When problems extend across floors and involve the “floor-ceiling interface”—a shared area between upper and lower floors—responsibility is typically divided based on structural levels: costs for shared components such as the structural layer are shared by residents of both floors; the upper-floor resident is responsible for the floor surface layer and related waterproofing structures, while the lower-floor resident is responsible for repairs to the ceiling plastering, painting, and other lower-surface interfaces.

3) Components affecting the building's overall appearance are the responsibility of the community and follow the “beneficiary pays” principle^[86]. For components that serve primarily decorative purposes and affect the building's overall appearance and street-facing interface—such as exterior edge beams, the outer sides of balustrades, and balcony decorative panels—once they are identified as part of the building's facade, they generally fall under the scope of common building maintenance, with costs typically apportioned among all residents. If the function or scope of benefit of such a component applies only to a subset of residents, the corresponding costs should be borne by that beneficiary group.

5.5.3 Integrating greening technology systems to establish a unified management and maintenance mechanism

Italian residents have a long-standing tradition of balcony greening. Data shows that the vast majority of projects feature greenery on balconies, while an additional 15.6% of projects have begun adopting new technologies such as movable planters and fixed planting beds, and are exploring unified management and maintenance mechanisms for greening. It is precisely this unified management and maintenance mechanism that has enabled balcony greening to maintain good results over the long term.

Take the Bosco Verticale (Milan Vertical Forest) project as an example: the greenery within the building is jointly owned by all apartment residents. Residents are not permitted to handle, remove, or replace the plants on their own; instead, maintenance and watering are managed centrally by the property management. This includes external pruning conducted twice a year by “flying gardeners” and two annual inspections and maintenance visits to residents’ balconies; The property management uses a digital system to continuously monitor humidity levels in the plant containers remotely and utilizes recycled graywater from the building to supplement daily irrigation. Residents pay an additional property fee of approximately 7 euros per square meter annually to maintain the plant communities on the building facade^①.

In Turin’s “25 Verde” project, the property management is also responsible for fertilizing and maintaining the plants in the large planters on the balconies, while utilizing a rainwater harvesting system to provide irrigation water for the greenery. The average annual cost of greenery maintenance per household is approximately 500 euros (about 4,000 RMB)^②. This integrated operation and maintenance model helps ensure the long-term effectiveness of balcony greening, reduces issues of neglect and lack of care in the later stages, and enhances both the quality of living and the overall appearance of the complex.

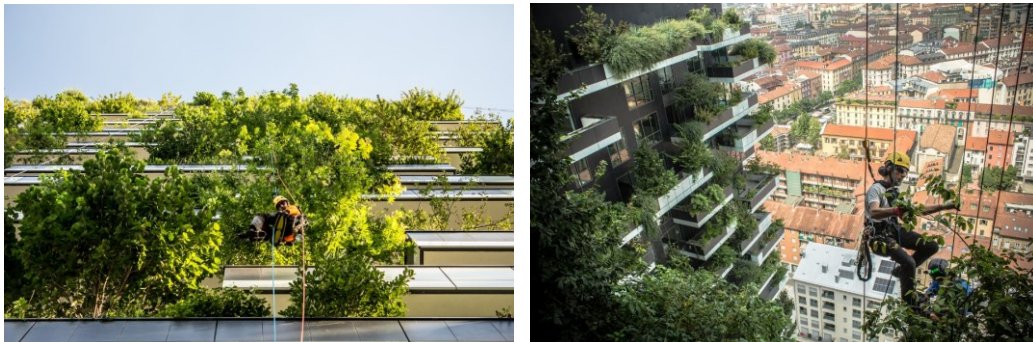


Figure 5.32 Unified maintenance and management of Bosco Verticale, Milan (Source: <https://www.stefanoboeriarchitetti.net/>)

① Worldcrunch. Bosco Verticale: the forest living in a Milan highrise[EB/OL]. [2026-03-15]. <https://worldcrunch.com/blog/bosco-verticale-the-forest-living-in-a-milan-highrise/amp>.

② Giardini in viaggio. Case albero e giungle cittadine con Stefania Naretto e Chiara Otella[EB/OL]. (2019-04-18)[2026-03-15]. <https://www.giardininviaggio.it/case-albero-e-giungle-cittadine-conferenza-verdisegni-con-stefania-naretto-e-chiara-otella-agronome-paesaggiste-20-marzo-2019/>.

5.6 Summary of This Chapter

Balconies are not only an extension of residential interior spaces but also form the interface between the residence and the city. This chapter adopts an urban perspective, summarizes balcony characteristics based on statistical analysis, and outlines design strategies from three aspects: environmental adaptation, interface design, and long-term sustainability.

Chapter 6 Research Summary and Implications

6.1 Research Summary

This study selected case studies of apartment complexes in representative Italian cities such as Rome, Milan, and Turin, focusing on balcony design and management and maintenance. Using methods such as sampling, typological analysis, and statistical analysis, the study revealed the multidimensional characteristics of residential buildings. Concurrently, by integrating literature reviews on Italian housing philosophies, policies and regulations, and management and operation models, the data was analyzed from both residential and urban perspectives, systematically identifying balcony characteristics and design strategies.

The study found that, in terms of balcony morphology: balconies primarily feature recessed or hybrid configurations, with widths typically ranging from 3.0 to 9.0 meters and depths concentrated between 1.5 and 3.0 meters. The proportion of balcony area within apartment floor plans ranges from 10% to 30%, the median facade coverage rate reaches 59.3%, and facade combinations exhibit significant diversity. From a residential perspective, design strategies regarding functional configuration, greenery planting, and detailing respond to shifts in residential philosophies, the desire for pastoral living, and the trend of global warming. From an urban perspective, design strategies concerning environmental adaptation, interface design, and long-term sustainability enrich the image of residential buildings, harmonize internal and external relationships, and ensure long-term quality.

The main contributions of this study are reflected in the following three aspects:

(1) Compilation of a case study collection of recent Italian apartment buildings.

Drawing on construction data from Rome, Milan, and Turin, a sample size was determined using a 5‰ sampling rate. Field surveys were conducted on nearly half of the cases, ultimately resulting in a case collection comprising 96 projects, 162 unit types, and 221 balconies, encompassing various types such as market-rate housing and social housing. This collection is highly systematic and representative, providing a solid foundation for identifying overall characteristics and conducting cross-case comparisons.

(2) A comprehensive analytical approach combining typological induction and statistical analysis was adopted. Based on redrawn drawings and field surveys, typological methods were used to identify typical features, establishing a coding system

comprising 33 items across three dimensions: project, unit type, and balcony. Statistical methods were then employed to quantitatively extract and cross-analyze relevant characteristics, thereby enhancing the objectivity of the research conclusions.

(3) Revealing residential development trends from a micro-level perspective of balcony design, while integrating design strategies and management/maintenance experiences. By examining the evolution and trends of Italian residential concepts, this study uses the balcony as a starting point to explore residential functions internally and the urban interface externally. It not only summarizes the primary strategies in recent Italian residential balcony design but also integrates relevant policies, regulations, and operation-maintenance models to summarize corresponding management and maintenance experiences.

Nevertheless, this study has certain limitations. On the one hand, information regarding the internal spaces of some projects relies primarily on secondary sources, resulting in an insufficient understanding of the actual spatial configuration and usage patterns of the balconies. On the other hand, the interviewees were primarily residents and architects, with insufficient coverage of developers, property management staff, and other relevant stakeholders; consequently, a deeper understanding of project development logic, post-construction operation and maintenance mechanisms, and multi-stakeholder collaborative governance processes remains to be explored. Future research could further deepen these findings by expanding the scope of field research, diversifying the types of interviewees, and supplementing the analysis with more primary data.

6.2 Insights and Implications

The above study demonstrates that Italian residential design places great emphasis on the significance of balconies in both residential and urban contexts. Through years of accumulation and market validation, a rich set of design strategies and sustainable operation and maintenance methods has gradually emerged, many of which offer valuable lessons for the construction of high-quality housing in China. The main insights are as follows:

6.2.1 Prioritize Balcony Design Research to Enhance Residential Functionality and Optimize Architectural Form

Drawing on trends in Italian residential development, China's residential

architecture should place greater emphasis on balcony design research. This approach should address residents' lifestyle needs to enhance residential functionality and explore innovative balcony forms to advance architectural design optimization. As balcony functions expand, their proportion of total floor area increases, and their coverage of building facades grows, balconies are increasingly becoming a key element influencing both the facade's aesthetic appeal and the spatial organization of floor plans.

In terms of functional organization, efforts should focus on refining balcony functions to meet residents' lifestyle needs. On one hand, auxiliary balconies can be added to moderately separate relatively open, display-oriented activities—such as leisure, sightseeing, and gardening—from daily household functions like clothes drying, storage, and equipment placement. On the other hand, the interfaces of auxiliary balconies can be optimized through hidden storage designs and semi-transparent balustrades to minimize visual clutter caused by exposed items. In terms of form and expression, innovative exploration of balcony shapes and configurations should be encouraged. Balconies can be integrated with the building's overall design concept, utilizing strategies such as recesses and projections, staggered arrangements, continuous balconies, corner balconies, and multi-level terraces in both plan and sectional views to create richer spatial layers and facade rhythms. Additionally, differentiated treatments of balustrade materials, planting methods, shading devices, and interface transparency can help enhance the expressiveness and distinctiveness of balconies. Innovative balcony design can optimize the overall architectural form, thereby addressing the current issues of homogenized facades and monotonous aesthetics in some apartment complexes.

6.2.2 Formulate Scientific Regulatory Measures to Guide the Rational Development of Residential Buildings

In recent years, some regions in China have encouraged the expansion of balcony areas by exempting them from floor area calculations or applying reduced floor area ratios. Projects represented by “fourth-generation housing” have also responded to residents' aspirations for a pastoral lifestyle and their demand for high-quality living environments by increasing balcony sizes and depths. However, in actual construction, some projects have disregarded local climatic conditions, using large balconies and high net-to-gross floor area ratios as marketing gimmicks. This has resulted in excessive balcony depth,

disproportionate dimensions, and restricted natural light, thereby compromising living quality and increasing residential energy consumption.

China should optimize regulatory measures for residential balconies to guide the rational development of residential buildings. On one hand, a reasonable control mechanism for the ratio of balcony area to building depth can be established. Drawing on the characteristics of Italian residential statistics—where balcony area ratios are relatively moderate and depth is controlled with caution—we must avoid indiscriminately increasing balcony size and depth at the expense of indoor natural light. Particularly for “fourth-generation housing,” a reasonable scale relationship should be established that harmonizes with factors such as unit depth, window configuration, and orientation. On the other hand, differentiated control standards can be established based on distinct climatic zones. China is a vast country with significant climatic differences between the north and south, and there are marked variations in balcony usage needs and climatic adaptability across different regions. In areas with hot summers and mild winters, moderately deepening balconies may help with summer shading and ventilation; in severely cold, cold, or regions with insufficient winter sunlight, excessively deep balconies may exacerbate insufficient indoor lighting and increase heating energy consumption; in high-humidity and rainy regions, attention must also be paid to issues such as moisture prevention, drainage, maintenance, and underutilized space. Therefore, relevant policies should avoid imposing a single design template on residential architecture nationwide. Instead, more flexible control standards and evaluation methods should be established based on regional conditions to prevent blind imitation of design forms, thereby returning balcony design to the fundamental principles of site-specific adaptation and sustainable development.

6.2.3 Improve Design and Operations Strategies to Ensure Quality Throughout the Residential Building Lifecycle

Balconies serve as both daily living spaces for residents and are directly exposed on the building facade, possessing the dual attributes of private use and public visibility. Post-construction modifications such as enclosing balconies, installing security grilles, and storing clutter, as well as improper usage, can easily lead to neighborhood disputes and create safety hazards, while also damaging the building’s facade and degrading the quality of the urban environment.

Drawing on Italian management and maintenance experience, the quality of residential buildings throughout their entire lifecycle should be ensured through long-term design approaches and operation and maintenance management measures. For post-construction additions such as window enclosures, sunshades, and external fixtures that may affect the harmony of the facade, unified standards should be established through a combination of resident consultation, property management, and regulatory constraints. For example, the installation of sunshades can be standardized in terms of model, style, material, color, installation location, and construction methods. Relevant requirements can be incorporated into homeowners' bylaws and property management regulations to minimize the damage caused to the overall appearance by arbitrary modifications made by individual residents.

For projects featuring integrated greening systems such as fixed planting beds, planters, and pots, it is even more critical to establish a maintenance mechanism covering the entire lifecycle. "Vertical greening" is not complete upon construction; subsequent irrigation, drainage, pruning, replacement, pest and disease control, as well as the allocation of maintenance responsibilities and cost-sharing, will directly impact the long-term sustainability of the greenery. Therefore, a long-term management mechanism covering the entire process—from design and construction through handover to operation and maintenance—should be established to ensure the quality of residential properties throughout their entire lifecycle.

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Appendix A Basic Information of the Case Study Collection

编号	城市	项目名	项目地址	调研日期	项目图片	编号	城市	项目名	项目地址	调研日期	项目图片
R-1	罗马	/	Via Casal Bertone, 56	2025.05.22		R-11	罗马	Domus Tiburtina	Via dei Monti Tiburtini, 770	0	
R-2	罗马	Torre Euroskey	Viale Giorgio Ribotta, 21	0		R-12	罗马	EUR Living	Viale del Ciclismo, 19	2025.05.21	
R-3	罗马	Citta del Sole	Via Arduino, 48	2025.05.21		R-13	罗马	Pietralatella	Via Alberto Pollio, 75	2025.05.22	
R-4	罗马	Domus Placidia	Viale Giorgio Cingoli, 13	0		R-14	罗马	Nuova Bonelli	Via di Villa Bonelli, 21	0	
R-5	罗马	/	Via del Porto Fluviale, 71	2025.05.22		R-15	罗马	Fronteparco	Via Giana Anguissola, 56	0	
R-6	罗马	Domus Appio Latino	Via Gino Capponi, 13	0		R-16	罗马	Alba Grotta Perfetta	Viale Alba de Cespedes, 68	0	
R-7	罗马	Social housing Via Pietro Bembo	Via Pietro Bembo, 23	0		R-17	罗马	Domus Unica	Via di Grotta Perfetta, 559	0	
R-8	罗马	Residenze Monticello	Via Aurelia, 278	0		R-18	罗马	/	Via del Forte Braschi, 2	0	
R-9	罗马	/	Via Val d'Orcia, 22	0		R-19	罗马	Spazio Flaminio	Via Cardinale de Luca, 3	0	
R-10	罗马	Monti della Breccia	Via Montegallo, 130	0		R-20	罗马	Ginestre Roma	Via Giana Anguissola, 47	0	

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编号	城市	项目名	项目地址	调研日期	项目图片	编号	城市	项目名	项目地址	调研日期	项目图片
M-1	米兰	Via Andrea Salaino, 10	Via Andrea Salaino, 10	0		M-11	米兰	/	Via Senigallia, 60	0	
M-2	米兰	/	Via Lomazzo, 52	0		M-12	米兰	K19	Via Antonio Kramer, 19	0	
M-3	米兰	/	Via Maestri Campionesi, 15	0		M-13	米兰	/	Via Bernardino Bellincione, 24	0	
M-4	米兰	Via Cenni Social Housing	Via Giuseppe Gabetti, 15/e	0		M-14	米兰	/	Ripa di Porta Ticinese, 87	2025.06.03	
M-5	米兰	La Corte Verde	Via Carlo de Cristoforis, 6	2025.06.03		M-15	米兰	Cascina Merlata Social Village	Via Pier Paolo Pasolini, 19	2025.04.12	
M-6	米兰	/	Viale Monte Grappa, 16	2025.06.03		M-16	米兰	Figino Il Borgo Sostenibile	Via Giovanni Battista Rasario, 18/B	0	
M-7	米兰	/	Via Vincenzo Capelli, 1	0		M-17	米兰	/	Via Piranesi, 44	0	
M-8	米兰	Bosco Verticale	Via Gaetano de Castilia, 11	2024.10.18		M-18	米兰	Porta Vittoria	Via Giovanni Cena, 8	0	
M-9	米兰	Citylife Residences	Via Senofonte, 2c	2024.12.15		M-19	米兰	Parco Vittoria	Via Marco Ulpio Traiano, 35 D	2025.05.03	
M-10	米兰	/	Piazza Alvaro Aalto, 3	2025.06.03		M-20	米兰	Novetredici Residential Complex	Via Gaspare Rosales, 8	2025.06.03	

Appendix A Basic Information of the Case Study Collection

(continued)

编号	城市	项目名	项目地址	调研日期	项目图片	编号	城市	项目名	项目地址	调研日期	项目图片
M-21	米兰	/	Via Mario Pichi, 15	2025.06.03		M-31	米兰	/	Via Cola Montano, 33	0	
M-22	米兰	/	Via Luigi Soderini, 58	0		M-32	米兰	Casa Selene	Viale Umbria, 98	0	
M-23	米兰	Casa Tersicore	Via Privata Luigi Sala, 12	0		M-33	米兰	Casa Calipso	Via Leone Tolstoi, 87	2025.05.15	
M-24	米兰	Residenze Carlo Erba	Piazza Carlo Erba, 6	2025.04.05		M-34	米兰	/	Via Filippo Argelati, 39	2025.06.03	
M-25	米兰	/	Via Andrea Maria Ampère, 56	2025.07.06		M-35	米兰	Uptown Milano	Via Pier Paolo Pasolini, 70	2025.04.12	
M-26	米兰	Residenze Ailanthus	Via Pietro Rondoni, 1	2025.05.15		M-36	米兰	5 Square	Via Antegnati, 7	0	
M-27	米兰	Arbitare Merezzate	Via Medici del vascello, 19	0		M-37	米兰	Domus Eleganza	Via Luigi Pirandello, 3	2025.05.15	
M-28	米兰	Torri Stella	Viale Achille Papa, 26	2025.05.03		M-38	米兰	Triology Towers	Via Gallarate, 11	2025.05.03	
M-29	米兰	/	Via Pier Paolo Pasolini, 9	2025.04.12		M-39	米兰	Green Domus Milano	Via Inverigo, 6	2025.05.03	
M-30	米兰	/	Via Marco Polo, 3	2025.06.03		M-40	米兰	/	Via Mario Pichi, 12	2025.06.03	

Appendix A Basic Information of the Case Study Collection

(continued)

编号	城市	项目名	项目地址	调研日期	项目图片	编号	城市	项目名	项目地址	调研日期	项目图片
M-41	米兰	Terminal Tower	Via Francesco Gonin, 11	0		T-1	都灵	Piazza Don Franco Delpiano	Corso Mediterraneo, 69	2025.04.13	
M-42	米兰	Domus Thalia	Via Tolstoi, 46	0		T-2	都灵	/	Via Assisi, 63	2025.7.8	
M-43	米兰	/	Via Valtorta, 32	0		T-3	都灵	/	Via Saluzzo, 29	0	
M-44	米兰	Forrest in Town	Via Bonaventura Zumbini, 39	0		T-4	都灵	/	Corso Giulio Cesare, 67	2025.6.21	
M-45	米兰	/	Via Leone Tolstoi, 64	2025.05.15		T-5	都灵	/	Via Saluzzo, 84	0	
M-46	米兰	Casa Eurinome	Via Piero della Francesca, 29	0		T-6	都灵	25 Verde	Via Gabriele Chiabrera, 25	2024.11.18 & 2025.6.8	
M-47	米兰	/	Via Paisiello, 11	0		T-7	都灵	/	Corso Giacomo Matteotti, 61	2025.4.14	
M-48	米兰	Oasi Isola	Via Alserio, 22	0		T-8	都灵	Casa Hollywood	Corso Regina Margherita, 104	2025.05.16	
M-49	米兰	/	Piazza Tirana, 24/4	0		T-9	都灵	COMPLESSO AREA EX-SIVA	Via Leini, 90	0	
M-50	米兰	East Town	Via Folli, 24	0		T-10	都灵	/	Via Valeggio, 5	0	

Appendix A Basic Information of the Case Study Collection

(continued)

编号	城市	项目名	项目地址	调研日期	项目图片	编号	城市	项目名	项目地址	调研日期	项目图片
T-11	都灵	/	Corso Racconigi, 236	2025.04.13		T-21	都灵	Uptown Torino	Corso Giovanni Lanza, 3	0	
T-12	都灵	/	Piazza Lorenzo Bernini, 2	2025.7.8		T-22	都灵	/	Via Rovereto, 51	0	
T-13	都灵	/	Via Fratelli Carle, 49	2025.6.20		T-23	都灵	/	Corso Francia, 45	2025.7.8	
T-14	都灵	Domus Lascaris	Via Lascaris, 7	0		T-24	都灵	/	Via Giacinto Collegno, 37	2025.7.8	
T-15	都灵	Parkview	Corso Dante, 101	2025.04.11		T-25	都灵	/	Via Tarino, 14	0	
T-16	都灵	Borgo Hermada	Via Don Giovanni Cocchi, 10	0		T-26	都灵	/	Via Odoardo Tabacchi, 29	0	
T-17	都灵	/	Via Lomellina, 34	0							
T-18	都灵	7ower	Corso Alessandro Tassoni, 4	2025.7.8							
T-19	都灵	Parco Lancia	Piazza della Costituzione, 31	2025.03.04							
T-20	都灵	/	Via Sandro Botticelli, 85	2025.5.30							

Appendix B Case Study Collection Data Code

Appendix Table 1 Data Code by Project Dimension

项目维度数据编码			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
编号	所在城市	项目编号	竣工年份	区位分布	建设方式	原建筑功能	用地尺度	楼栋组团构成	总建筑面积(m²)	楼层数	住宅类型	阳台剖面组合类型	阳台立面组合类型	阳台开放程度	阳台栏杆界面类型	阳台遮阳类型	阳台绿化类型
1	罗马	R-1	2011	2	2	3	2	2	/	8	1	4	2	1	2	2,3	1
2	罗马	R-2	2013	3	1	/	3	2	/	30	1	1	2	2	1	/	2
3	罗马	R-3	2016	2	3	4	3	2	/	13	1	1	4	1	2	2	1
4	罗马	R-4	2016	2	1	/	3	1	/	9	1	1	4	3	1	/	1
5	罗马	R-5	2017	2	3	3	3	2	/	7	1	1	4	1	1,2	1	2
6	罗马	R-6	2017	2	2	1	1	1	2900	8	1	1	2	1	2	/	1
7	罗马	R-7	2019	2	1	/	2	1	2362	4	2	1	2	1	2	3	1
8	罗马	R-8	2020	2	2	7	2	1	11500	5	1	1	3	1	1,2	1	2
9	罗马	R-9	2021	3	1	/	3	1	2400	5	1	1	2	1	1,2	1	1
10	罗马	R-10	2021	3	1	/	3	2	/	7	1	1	4	1	1,2,3	2,3	2
11	罗马	R-11	2022	3	2	3	2	2	4600	6	3	1	2	3	1	1	1
12	罗马	R-12	2023	2	2	1	2	1	1600	7	1	1	4	1	2	1	2
13	罗马	R-13	2023	2	2	1	2	1	/	7	1	1	2	1	1,2	/	1
14	罗马	R-14	2023	2	2	3	2	2	9400	6	3	1	2	3	1	1	1
15	罗马	R-15	2024	3	1	/	3	2	/	8	1	1	2	1	1,2	/	2
16	罗马	R-16	2025	3	1	/	2	1	/	5	1	1	4	1	2	3	1
17	罗马	R-17	2025	3	1	/	3	1	/	9	1	1	2	1	3	/	1
18	罗马	R-18	2026	2	1	/	3	1	3400	8	1	1	4	1	2,3	3	2
19	罗马	R-19	2026	2	2	6	2	1	2000	6	1	1	4	2	2,3	3	1
20	罗马	R-20	2026	3	1	/	3	2	/	7	1	1	2	1	1,2	1	1
21	米兰	M-1	2011	2	2	1	2	1	5200	8	1	1	4	1	2	3	1
22	米兰	M-2	2011	2	2	3	2	2	6600	16	1	1	2	1	3	1	1
23	米兰	M-3	2012	2	2	1	1	1	/	8	1	1	4	1	1,2	3	1
24	米兰	M-4	2012	3	1	/	3	2	13000	8	2	1	2	1	1,3	3	1
25	米兰	M-5	2013	2	2	4	2	1	4019	10	1	1	4	1	2	3	1
26	米兰	M-6	2013	2	2	1	1	1	5173	8	1	1	1	1	2,3	/	2
27	米兰	M-7	2013	2	2	4	2	2	14100	5	1	1	2	1	3	/	1
28	米兰	M-8	2014	2	2	5	3	2	18200	26	1	3	3	1	1	4	2
29	米兰	M-9	2014	2	2	3	3	2	38000	13	1	4	3	1	1,2	/	1
30	米兰	M-10	2014	2	2	5	3	2	29500	34	1	1	3	1	2	/	1
31	米兰	M-11	2014	3	1	/	3	2	/	4	2	1	3	1	2	/	1
32	米兰	M-12	2014	2	2	3	2	1	3705	7	1	4	3	1	3	/	1
33	米兰	M-13	2014	2	2	1	2	1	/	4	1	4	3	1	2	/	1
34	米兰	M-14	2015	2	3	3	2	2	7417	6	2	1	2	1	2	/	2
35	米兰	M-15	2015	3	1	/	3	2	/	24	3	1	4	1	1,2	3	1
36	米兰	M-16	2015	3	1	/	3	2	26500	4	2	1	2	1	3	/	1
37	米兰	M-17	2015	2	2	2	2	2	23400	11	1	1	4	1	2	3	1
38	米兰	M-18	2015	2	2	4	2	2	/	7	1	1	4	1	1,2	3	1
39	米兰	M-19	2016	2	2	3	3	2	51500	12	1	1	2	1	1,3	/	1
40	米兰	M-20	2016	2	2	4	2	2	/	14	1	1	2	1	2	/	1
41	米兰	M-21	2018	2	2	3	2	1	1462	10	1	1	2	1	1,2	/	1
42	米兰	M-22	2018	2	2	5	2	1	1900	10	1	1	2	1	2	/	1
43	米兰	M-23	2018	2	1	/	2	1	4900	6	1	1	4	1	1,2	3	1
44	米兰	M-24	2019	2	3	3	3	2	19700	9	1	1	2	1	3	/	1
45	米兰	M-25	2019	2	2	2	2	2	12600	7	1	1	3	1	1,2	1,3	1
46	米兰	M-26	2020	2	3	2	2	1	/	9	1	1	2	1	3	1	1
47	米兰	M-27	2020	3	1	/	3	2	22240	8	2	1	2	1	2	2	1
48	米兰	M-28	2021	2	2	3	3	2	/	9	1	1	2	1	1,2	1	1
49	米兰	M-29	2021	2	1	/	3	2	78215	26	2	1	4	1	1,2	3	1
50	米兰	M-30	2021	2	2	6	2	1	15345	11	1	1	2	1	2	/	2
51	米兰	M-31	2021	2	3	2	2	1	/	9	1	1	2	1	2	/	1
52	米兰	M-32	2021	2	2	1	2	1	7500	11	1	1	2	1	1,2	/	1
53	米兰	M-33	2022	2	2	5	2	1	2500	8	1	1	2	1	1,2	/	1
54	米兰	M-34	2022	2	1	/	3	2	4386	5	2	1	1	1	2	1	1
55	米兰	M-35	2022	3	1	/	3	2	63000	24	1	1	4	1	2,3	3	2
56	米兰	M-36	2022	3	3	3	3	2	35610	5	2	1	4	1	1,2	1,3	1
57	米兰	M-37	2023	2	2	2	1	1	3900	8	1	1	2	1	2	1,3	1
58	米兰	M-38	2023	2	2	3	2	2	8500	18	1	1	4	1	1,2	3	1
59	米兰	M-39	2023	2	3	1	2	1	/	8	1	1	4	1	1,2	/	1
60	米兰	M-40	2023	2	3	4	2	2	2244	4	2	1	3	1	2	/	1
61	米兰	M-41	2023	2	2	3	2	1	/	17	1	1	2	1	1,3	/	1
62	米兰	M-42	2023	2	2	4	1	1	/	8	1	1	2	1	1,2	/	1
63	米兰	M-43	2023	2	1	/	3	2	/	10	1	1	3	1	2,2	/	1
64	米兰	M-44	2023	2	2	3	3	2	/	4	1	1	2	1	2	/	1
65	米兰	M-45	2024	2	3	1	3	2	18000	10	2	1	2	1	2	/	1

Appendix B Case Study Collection Data Code

(continued)

项目维度数据编码			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
编号	所在城市	项目编号	竣工年份	区位分布	建设方式	原建筑功能	用地尺度	楼栋组团构成	总建筑面积(m²)	楼层数	住宅类型	阳台剖面组合类型	阳台立面组合类型	阳台开放程度	阳台栏杆界面类型	阳台遮阳类型	阳台绿化类型
66	米兰	M-46	2024	2	2	5	1	1	/	7	1	1	2	1	1,2,3	3	1
67	米兰	M-47	2025	2	2	2	1	1	9950	9	1	1	3	1	3	3	1
68	米兰	M-48	2025	2	2	2	1	1	14970	7	1	1	2	1	2	/	2
69	米兰	M-49	2026	2	1	/	2	1	2660	9	1	1	2	1	1,2	/	1
70	米兰	M-50	2026	2	1	/	2	1	8250	7	1	1	4	1	2	3	1
71	都灵	T-1	2010	2	2	3	3	2	/	8	1	1	2	1	1,2	1	1
72	都灵	T-2	2010	2	2	3	3	2	/	8	2	1	2	1	2	1	1
73	都灵	T-3	2010	2	3	4	1	1	2300	4	1	1	1	1	2,3	/	1
74	都灵	T-4	2011	2	1	/	1	1	/	8	1	1	2	1	1	1	1
75	都灵	T-5	2011	2	3	1	1	1	2500	5	1	1	4	1	2	/	1
76	都灵	T-6	2012	2	2	3	2	1	7500	6	1	2	3	1	2	4	2
77	都灵	T-7	2012	2	2	5	1	1	3000	7	1	1	2	1	2	/	1
78	都灵	T-8	2014	2	3	7	1	1	3500	10	1	1	4	1	3	3	1
79	都灵	T-9	2015	3	1	/	3	2	3800	6	2	1	2	1	2	3	1
80	都灵	T-10	2015	2	2	2	1	1	/	6	1	1	2	1	2	/	1
81	都灵	T-11	2016	2	2	3	3	2	/	9	2	1	2	1	2	/	1
82	都灵	T-12	2018	2	3	1	2	1	3800	8	1	1	4	1	2	3	1
83	都灵	T-13	2018	2	3	1	1	1	/	5	1	1	2	1	2	/	1
84	都灵	T-14	2020	1	3	2	2	1	/	5	1	1	3	1	3	1	1
85	都灵	T-15	2021	2	3	3	3	2	31000	9	1	4	4	1	2,3	3	1
86	都灵	T-16	2021	2	3	1	2	2	/	5	1	1	2	1	2,3	3	1
87	都灵	T-17	2021	2	3	4	1	1	/	5	1	1	2	1	1,3	/	1
88	都灵	T-18	2022	2	2	1	2	1	/	11	1	1	2	1	2,3	3	2
89	都灵	T-19	2023	2	2	3	3	2	/	17	3	1	4	1	1,3	/	1
90	都灵	T-20	2023	2	2	3	2	1	2000	5	2	1	4	1	2	1	1
91	都灵	T-21	2023	2	2	1	3	1	4500	4	1	1	1	1	3	3	1
92	都灵	T-22	2024	2	2	3	2	1	3700	7	1	1	4	2	2	/	1
93	都灵	T-23	2025	2	2	7	1	1	1690	8	1	1	2	1	3	/	1
94	都灵	T-24	2025	2	3	1	1	1	/	5	1	1	3	1	2	/	1
95	都灵	T-25	2025	2	2	1	1	1	2500	7	1	1	4	1	1,2	3	1
96	都灵	T-26	2025	2	2	2	1	1	/	4	1	1	4	1	2,3	3	1

Appendix B Case Study Collection Data Code

Appendix Table 2 Data Code by Unit Dimension

户型维度数据编码				1	2-a	2-b	3	4	5	6	7	8
编号	所在城市	所属项目	户型编号	居室数	户型总面积 (阳台计全 面积口径) (m²)	户型面积 (不 计阳台面积口 径) (m²)	户型采光 类型	阳台数量	多阳台位 置组合关 系	阳台总 面积(m²)	阳台面积 配比	阳台立面 覆盖度
1	罗马	R-2	R-2-1-1	1	53.3	46.6	1	1	/	6.7	12.5%	100.0%
2	罗马	R-2	R-2-2-1	2	107.8	94.0	2	2	2	13.7	12.8%	73.4%
3	罗马	R-2	R-2-2-2	2	160.0	139.3	2	2	2	20.7	12.9%	77.6%
4	罗马	R-4	R-4-1-1	1	65.2	45.1	1	1	/	20.1	30.8%	100.0%
5	罗马	R-4	R-4-1-2	1	49.6	34.9	1	1	/	14.6	29.5%	100.0%
6	罗马	R-4	R-4-2-1	2	93.3	62.9	1	1	/	30.4	32.6%	49.9%
7	罗马	R-5	R-5-1-1	1	80.1	55.1	1	1	/	25.0	31.2%	100.0%
8	罗马	R-9	R-9-1-1	1	51.2	34.7	1	1	/	16.5	32.3%	100.0%
9	罗马	R-10	R-10-2-1	2	115.6	82.5	1	1	/	33.0	28.6%	100.0%
10	罗马	R-10	R-10-2-2	2	106.0	66.3	2	1	/	39.7	37.5%	100.0%
11	罗马	R-10	R-10-2-3	2	133.4	81.5	2	1	/	51.9	38.9%	100.0%
12	罗马	R-10	R-10-2-4	2	107.2	76.0	2	1	/	31.2	29.1%	100.0%
13	罗马	R-10	R-10-3-1	3	120.0	85.1	4	1	/	34.9	29.1%	87.3%
14	罗马	R-13	R-13-1-1	1	60.9	38.6	2	1	/	22.3	36.6%	59.9%
15	罗马	R-13	R-13-1-2	1	77.0	53.3	2	1	/	23.7	30.8%	49.2%
16	罗马	R-15	R-15-1-1	1	85.4	59.2	1	1	/	26.1	30.6%	100.0%
17	罗马	R-15	R-15-1-2	1	90.2	49.9	3	1	/	40.3	44.7%	100.0%
18	罗马	R-15	R-15-2-1	2	86.8	61.4	2	2	2	25.4	29.3%	46.8%
19	罗马	R-15	R-15-2-2	2	174.9	104.8	2	1	/	70.1	40.1%	100.0%
20	罗马	R-15	R-15-2-3	2	105.0	70.9	3	1	/	34.1	32.4%	100.0%
21	罗马	R-15	R-15-3-1	3	118.5	81.9	2	2	2	36.6	30.9%	67.3%
22	罗马	R-16	R-16-1-1	1	72.1	50.5	1	1	/	21.6	30.0%	100.0%
23	罗马	R-16	R-16-2-1	2	113.8	75.5	2	1	/	38.3	33.6%	100.0%
24	罗马	R-16	R-16-3-1	3	143.9	88.4	2	1	/	55.6	38.6%	100.0%
25	罗马	R-17	R-17-2-1	2	95.6	75.6	1	1	/	20.0	20.9%	67.7%
26	罗马	R-17	R-17-2-2	2	114.0	85.1	3	1	/	28.9	25.3%	58.3%
27	罗马	R-17	R-17-2-3	2	124.0	92.4	3	1	/	31.6	25.5%	58.7%
28	罗马	R-17	R-17-2-4	2	102.9	81.2	4	2	2	21.7	21.1%	52.5%
29	罗马	R-17	R-17-2-5	2	112.8	85.3	1	1	/	27.5	24.4%	82.7%
30	罗马	R-20	R-20-1-1	1	69.8	53.2	1	1	/	16.6	23.8%	100.0%
31	罗马	R-20	R-20-2-1	2	125.2	89.0	1	1	/	36.2	28.9%	100.0%
32	罗马	R-20	R-20-3-1	3	169.8	110.2	2	1	/	59.6	35.1%	85.0%
33	罗马	R-20	R-20-4-1	4	198.6	143.3	2	1	/	55.3	27.8%	64.3%
34	米兰	M-10	M-10-1-1	1	77.7	58.3	2	1	/	19.4	25.0%	45.8%
35	米兰	M-10	M-10-1-2	1	86.1	66.2	2	1	/	19.8	23.0%	68.8%
36	米兰	M-10	M-10-2-1	2	121.9	89.4	2	1	/	32.6	26.7%	36.7%
37	米兰	M-10	M-10-3-1	3	132.1	109.2	4	1	/	22.8	17.3%	30.4%
38	米兰	M-10	M-10-3-2	3	165.1	144.7	4	1	/	20.5	12.4%	17.0%
39	米兰	M-10	M-10-4-1	4	199.5	153.7	4	2	4	45.7	22.9%	37.4%
40	米兰	M-11	M-11-2-1	2	56.6	50.3	3	2	1	6.4	11.2%	20.6%
41	米兰	M-15	M-15-1-1	1	57.2	52.7	1	1	/	4.6	8.0%	26.6%
42	米兰	M-15	M-15-1-2	1	58.1	53.9	2	1	/	4.1	7.1%	18.3%
43	米兰	M-15	M-15-1-3	1	80.1	53.0	2	2	2	27.1	33.8%	61.5%
44	米兰	M-15	M-15-2-1	2	75.1	70.3	2	1	/	4.8	6.4%	12.7%
45	米兰	M-15	M-15-2-2	2	87.9	84.1	2	1	/	3.8	4.3%	12.2%
46	米兰	M-15	M-15-3-1	3	101.1	97.1	2	1	/	4.0	3.9%	10.7%
47	米兰	M-17	M-17-2-1	2	93.2	75.9	2	1	/	17.3	18.6%	35.9%
48	米兰	M-17	M-17-3-1	3	193.7	134.9	2	1	/	58.7	30.3%	73.3%
49	米兰	M-18	M-18-1-1	1	51.2	38.8	1	1	/	12.3	24.1%	100.0%
50	米兰	M-18	M-18-1-2	1	58.3	58.3	2	0	/	0.0	0.0%	0.0%
51	米兰	M-18	M-18-2-1	2	153.4	126.4	3	1	/	27.0	17.6%	100.0%
52	米兰	M-18	M-18-2-2	2	111.1	90.9	3	1	/	20.2	18.1%	100.0%
53	米兰	M-18	M-18-3-1	3	215.2	166.5	4	1	/	48.7	22.6%	51.0%
54	米兰	M-19	M-19-1-1	1	75.0	52.5	1	1	/	22.5	30.0%	100.0%
55	米兰	M-19	M-19-1-2	1	83.8	72.8	1	1	/	11.0	13.1%	48.0%
56	米兰	M-19	M-19-2-1	2	151.3	109.5	4	2	2	41.8	27.6%	46.7%
57	米兰	M-19	M-19-2-2	2	129.1	90.4	4	2	2	38.7	30.0%	53.7%
58	米兰	M-19	M-19-2-3	2	180.0	97.2	2	2	1	82.8	46.0%	49.0%
59	米兰	M-19	M-19-2-4	2	129.6	100.2	2	2	2	29.4	22.7%	48.6%
60	米兰	M-19	M-19-2-5	2	161.9	105.1	2	2	2	56.9	35.1%	42.9%
61	米兰	M-19	M-19-2-6	2	130.3	104.0	2	2	2	26.3	20.2%	37.8%
62	米兰	M-19	M-19-2-7	2	148.7	93.2	2	2	2	55.6	37.4%	72.6%
63	米兰	M-19	M-19-2-8	2	155.0	96.7	2	2	2	58.3	37.6%	81.0%
64	米兰	M-19	M-19-2-9	2	147.1	97.4	2	2	2	49.7	33.8%	63.1%

Appendix B Case Study Collection Data Code

(continued)

户型维度数据编码			1	2-a	2-b	3	4	5	6	7	8	
编号	所在城市	所属项目	户型编号	居室数	户型总面积 (阳台计全 面积口径) (m²)	户型面积 (不 计阳台面积口 径) (m²)	户型采光 类型	阳台数量	多阳台位 置组合关 系	阳台总 面积(m²)	阳台面积 配比	阳台立面 覆盖度
65	米兰	M-19	M-19-2-10	2	130.2	96.2	4	2	2	34.0	26.1%	31.0%
66	米兰	M-19	M-19-2-11	2	121.4	92.9	2	2	2	28.5	23.5%	48.6%
67	米兰	M-19	M-19-3-1	3	204.0	148.1	2	3	2	55.9	27.4%	60.0%
68	米兰	M-19	M-19-3-2	3	159.7	127.8	2	3	2	31.9	20.0%	34.8%
69	米兰	M-25	M-25-1-1	1	89.1	73.2	1	1	/	15.8	17.8%	57.0%
70	米兰	M-25	M-25-3-1	3	197.9	137.0	3	2	3	60.9	30.8%	86.2%
71	米兰	M-27	M-27-1-1	1	54.0	46.4	1	1	/	7.6	14.2%	47.2%
72	米兰	M-27	M-27-1-2	1	42.5	37.4	1	1	/	5.1	12.0%	39.6%
73	米兰	M-27	M-27-2-1	2	68.7	61.4	1	1	/	7.4	10.7%	44.3%
74	米兰	M-27	M-27-2-2	2	93.7	85.6	4	1	/	8.1	8.6%	16.4%
75	米兰	M-27	M-27-3-1	3	102.0	93.4	4	1	/	8.6	8.4%	21.7%
76	米兰	M-29	M-29-1-1	1	72.6	54.1	1	1	/	18.4	25.4%	100.0%
77	米兰	M-29	M-29-1-2	1	89.9	65.5	1	1	/	24.4	27.2%	100.0%
78	米兰	M-29	M-29-1-3	1	84.8	68.1	1	1	/	16.7	19.7%	62.1%
79	米兰	M-29	M-29-2-1	2	75.0	67.1	1	1	/	7.9	10.5%	18.7%
80	米兰	M-29	M-29-2-2	2	93.2	77.4	1	1	/	15.9	17.0%	47.1%
81	米兰	M-29	M-29-2-3	2	95.6	82.5	3	1	/	13.2	13.8%	39.9%
82	米兰	M-29	M-29-2-4	2	107.4	92.2	3	1	/	15.2	14.2%	42.9%
83	米兰	M-29	M-29-2-5	2	100.8	92.4	2	1	/	8.4	8.3%	16.7%
84	米兰	M-29	M-29-2-6	2	102.3	91.4	2	1	/	10.9	10.6%	20.8%
85	米兰	M-29	M-29-2-7	2	103.5	88.6	2	1	/	14.9	14.4%	41.1%
86	米兰	M-29	M-29-2-8	2	121.4	92.6	2	1	/	28.8	23.7%	100.0%
87	米兰	M-29	M-29-3-1	3	126.6	115.3	2	1	/	11.3	8.9%	18.1%
88	米兰	M-29	M-29-3-2	3	119.4	108.9	2	1	/	10.5	8.8%	18.1%
89	米兰	M-33	M-33-2-1	2	100.2	86.9	4	1	/	13.3	13.2%	18.8%
90	米兰	M-36	M-36-1-1	1	83.8	60.3	1	1	/	23.4	28.0%	100.0%
91	米兰	M-36	M-36-2-1	2	122.8	108.8	3	1	/	14.0	11.4%	100.0%
92	米兰	M-36	M-36-3-1	3	143.0	91.0	2	1	/	52.0	36.4%	100.0%
93	米兰	M-38	M-38-3-1	3	181.9	139.2	3	1	/	42.7	23.5%	35.8%
94	米兰	M-39	M-39-1-1	1	87.2	57.3	1	1	/	29.9	34.3%	100.0%
95	米兰	M-39	M-39-2-1	2	133.7	86.1	3	1	/	47.5	35.6%	100.0%
96	米兰	M-41	M-41-1-1	1	71.8	58.0	2	1	/	13.8	19.3%	31.4%
97	米兰	M-45	M-45-2-1	2	92.4	89.1	4	1	/	3.3	3.6%	10.9%
98	米兰	M-45	M-45-2-2	2	100.2	98.2	2	1	/	2.0	2.0%	5.7%
99	米兰	M-45	M-45-2-3	2	94.6	92.8	2	1	/	1.8	1.9%	5.4%
100	米兰	M-49	M-49-2-1	2	118.2	91.4	3	2	3	26.8	22.7%	60.2%
101	米兰	M-49	M-49-2-2	2	102.8	80.9	4	2	3	22.0	21.4%	41.2%
102	米兰	M-50	M-50-1-1	1	61.6	45.9	1	1	/	15.6	25.4%	100.0%
103	米兰	M-50	M-50-2-1	2	130.9	86.0	3	2	3	44.9	34.3%	100.0%
104	米兰	M-50	M-50-3-1	3	153.8	99.9	4	2	3	53.8	35.0%	100.0%
105	都灵	T-2	T-2-1-1	1	52.3	45.9	1	1	/	6.4	12.3%	48.5%
106	都灵	T-2	T-2-1-2	1	57.8	43.6	3	2	3	14.2	24.5%	100.0%
107	都灵	T-2	T-2-1-3	1	50.6	44.5	1	1	/	6.2	12.2%	47.8%
108	都灵	T-2	T-2-1-4	1	55.9	49.6	1	1	/	6.3	11.3%	27.4%
109	都灵	T-2	T-2-1-5	1	55.7	45.0	1	1	/	10.8	19.3%	96.0%
110	都灵	T-2	T-2-1-6	1	56.2	43.1	3	2	3	13.1	23.3%	82.4%
111	都灵	T-2	T-2-1-7	1	50.4	35.4	1	1	/	14.9	29.6%	100.0%
112	都灵	T-2	T-2-1-8	1	62.0	50.2	1	1	/	11.8	19.0%	100.0%
113	都灵	T-2	T-2-1-9	1	61.4	54.7	1	1	/	6.7	11.0%	47.0%
114	都灵	T-2	T-2-1-10	1	65.2	53.1	1	1	/	12.1	18.6%	79.0%
115	都灵	T-2	T-2-2-1	2	81.3	65.8	1	1	/	15.5	19.1%	69.7%
116	都灵	T-2	T-2-2-2	2	92.4	78.1	1	1	/	14.3	15.4%	39.5%
117	都灵	T-2	T-2-2-3	2	83.7	67.4	3	2	3	16.3	19.4%	61.9%
118	都灵	T-2	T-2-2-4	2	90.6	72.8	3	2	3	17.7	19.6%	100.0%
119	都灵	T-2	T-2-2-5	2	75.3	62.5	1	1	/	12.8	17.0%	54.3%
120	都灵	T-2	T-2-2-6	2	81.7	70.7	3	2	3	11.0	13.5%	64.8%
121	都灵	T-2	T-2-2-7	2	85.9	64.8	3	2	3	21.1	24.6%	98.4%
122	都灵	T-2	T-2-2-8	2	84.3	69.7	3	2	3	14.6	17.3%	71.0%
123	都灵	T-2	T-2-2-9	2	122.7	103.3	4	2	2	19.4	15.8%	28.3%
124	都灵	T-2	T-2-2-10	2	84.3	70.9	3	1	/	13.5	16.0%	65.6%
125	都灵	T-2	T-2-2-11	2	93.8	79.1	4	2	2	14.7	15.6%	38.9%
126	都灵	T-2	T-2-2-12	2	69.1	63.0	2	1	/	6.1	8.8%	22.2%
127	都灵	T-2	T-2-2-13	2	88.8	64.1	3	2	3	24.7	27.9%	100.0%
128	都灵	T-2	T-2-2-14	2	105.9	81.1	3	2	3	24.7	23.4%	74.4%

Appendix B Case Study Collection Data Code

(continued)

户型维度数据编码				1	2-a	2-b	3	4	5	6	7	8
编号	所在城市	所属项目	户型编号	居室数	户型总面积 (阳台计全 面积口径) (m ²)	户型面积 (不 计阳台面积口 径) (m ²)	户型采光 类型	阳台数量	多阳台位 置组合关 系	阳台总 面积(m ²)	阳台面积 配比	阳台立面 覆盖度
129	都灵	T-2	T-2-3-1	3	124.9	104.8	2	1	/	20.1	16.1%	35.8%
130	都灵	T-4	T-4-2-1	2	117.4	98.0	4	2	3	19.4	16.5%	39.6%
131	都灵	T-5	T-5-1-1	1	60.9	60.9	1	0	/	0.0	0.0%	0.0%
132	都灵	T-7	T-7-2-1	2	207.7	159.2	2	1	/	48.5	23.4%	100.0%
133	都灵	T-10	T-10-2-1	2	133.8	127.2	3	1	/	6.7	5.0%	28.4%
134	都灵	T-10	T-10-2-2	2	116.8	110.9	4	2	3	5.9	5.1%	27.5%
135	都灵	T-15	T-15-2-1	2	142.5	102.3	3	2	3	40.2	28.2%	100.0%
136	都灵	T-15	T-15-2-2	2	142.6	107.9	3	2	3	34.7	24.3%	79.8%
137	都灵	T-18	T-18-2-1	2	181.8	143.6	4	2	4	38.2	21.0%	77.8%
138	都灵	T-19	T-19-1-1	1	94.2	76.7	3	2	3	17.5	18.6%	53.3%
139	都灵	T-19	T-19-1-2	1	86.0	74.5	3	2	3	11.5	13.4%	40.3%
140	都灵	T-19	T-19-1-3	1	63.2	52.2	1	1	/	11.0	17.4%	23.0%
141	都灵	T-19	T-19-1-4	1	71.9	65.5	2	1	/	6.4	8.9%	19.8%
142	都灵	T-19	T-19-2-1	2	126.6	110.3	4	1	/	16.3	12.9%	29.9%
143	都灵	T-19	T-19-2-2	2	125.5	118.2	2	1	/	7.3	5.8%	13.5%
144	都灵	T-19	T-19-2-3	2	139.6	122.2	2	1	/	17.3	12.4%	29.0%
145	都灵	T-19	T-19-2-4	2	125.8	103.2	4	2	3	22.6	18.0%	35.5%
146	都灵	T-19	T-19-2-5	2	71.3	64.9	2	1	/	6.4	9.0%	19.8%
147	都灵	T-19	T-19-2-6	2	114.6	103.2	4	2	3	11.4	10.0%	22.5%
148	都灵	T-19	T-19-3-1	3	161.9	143.7	4	2	3	18.2	11.3%	37.5%
149	都灵	T-19	T-19-3-2	3	139.0	121.7	4	2	3	17.3	12.4%	24.7%
150	都灵	T-19	T-19-3-3	3	131.7	114.1	3	2	3	17.6	13.4%	39.4%
151	都灵	T-20	T-20-2-1	2	134.3	109.2	3	1	/	25.1	18.7%	50.3%
152	都灵	T-20	T-20-3-1	3	172.3	123.6	4	2	3	48.6	28.2%	100.6%
153	都灵	T-20	T-20-3-2	3	193.2	134.2	3	2	3	59.1	30.6%	83.0%
154	都灵	T-22	T-22-2-1	2	129.0	91.7	3	2	3	37.3	28.9%	100.0%
155	都灵	T-22	T-22-2-2	2	160.0	102.0	3	2	3	58.0	36.2%	100.0%
156	都灵	T-22	T-22-2-3	2	118.2	87.0	3	2	3	31.2	26.4%	94.5%
157	都灵	T-22	T-22-2-4	2	109.8	84.8	3	2	3	25.0	22.8%	93.5%
158	都灵	T-22	T-22-3-1	3	167.6	111.4	4	2	4	56.2	33.5%	85.3%
159	都灵	T-22	T-22-3-2	3	221.9	139.4	4	3	4	82.5	37.2%	90.0%
160	都灵	T-23	T-23-2-1	2	82.6	74.4	2	1	/	8.2	9.9%	59.9%
161	都灵	T-23	T-23-2-2	2	126.7	99.4	3	2	3	27.3	21.6%	79.5%
162	都灵	T-23	T-23-3-1	3	124.6	111.6	2	1	/	13.1	10.5%	29.9%

Appendix Table 3 Data Code by Balcony Dimension

阳台维度数据编码					1	2	3	4	5-a	5-b	5-c	5-d	5-e	6	7	8	9	10
编号	所在城市	所属项目	所属户型	阳台编号	平面形状	结构 支承 方式	相对 轮廓 位置	界面 朝向	联通 起居 室	联通 独立 厨房	联通 卧室 甲	联通 卧室 乙	联通 其他 空间	面宽 (m)	进深 (m)	面宽 进深 比	功能 类型	家具 类型
1	罗马	R-2	R-2-1-1	R-2-1-1-1	1	1	1	0	1	0	0	0	0	4.2	1.6	2.6	1	1
2	罗马	R-2	R-2-2-1	R-2-2-1-1	1	1	1	0	1	0	0	0	0	8.4	1.6	5.3	1	0
3	罗马	R-2	R-2-2-1	R-2-2-1-2	1	2	2	0	1	0	0	0	0	5.8	2.0	2.9	2	1
4	罗马	R-2	R-2-2-2	R-2-2-2-1	1	1	1	0	1	0	0	0	0	12.6	1.6	7.9	1	0
5	罗马	R-2	R-2-2-2	R-2-2-2-2	1	2	2	0	1	0	0	0	0	5.8	2.0	2.9	2	1
6	罗马	R-4	R-4-1-1	R-4-1-1-1	1	3	1	0	1	0	1	0	0	9.8	2.0	4.9	1	0
7	罗马	R-4	R-4-1-2	R-4-1-2-1	1	3	1	0	1	0	1	0	0	5.5	2.6	2.1	1	0
8	罗马	R-4	R-4-2-1	R-4-2-1-1	1	3	1	0	1	0	1	1	1	11.4	2.7	4.2	1	1
9	罗马	R-5	R-5-1-1	R-5-1-1-1	1	1	1	0	1	0	1	0	0	8.0	3.2	2.5	1	0
10	罗马	R-9	R-9-1-1	R-9-1-1-1	1	1	1	0	1	0	1	0	0	6.0	2.8	2.1	1	1
11	罗马	R-10	R-10-2-1	R-10-2-1-1	1	2	1	0	1	1	1	1	0	12.0	2.8	4.3	1	1
12	罗马	R-10	R-10-2-2	R-10-2-2-1	2	2	1	0	1	1	1	1	1	17.1	1.9	9.0	1	1
13	罗马	R-10	R-10-2-3	R-10-2-3-1	2	2	1	0	1	1	1	1	1	20.4	2.1	9.7	1	0
14	罗马	R-10	R-10-2-4	R-10-2-4-1	1	2	1	0	1	1	1	1	0	12.4	2.5	5.0	1	1
15	罗马	R-10	R-10-3-1	R-10-3-1-1	1	2	1	0	1	1	1	1	0	12.4	3.0	4.1	1	0
16	罗马	R-13	R-13-1-1	R-13-1-1-1	1	2	1	0	1	0	1	0	0	8.0	2.8	2.9	1	1
17	罗马	R-13	R-13-1-2	R-13-1-2-1	1	2	1	0	1	0	1	0	1	8.4	2.8	3.0	1	1
18	罗马	R-15	R-15-1-1	R-15-1-1-1	1	3	1	0	1	1	1	0	0	9.5	2.7	3.5	1	0
19	罗马	R-15	R-15-1-2	R-15-1-2-1	1	1	1	0	1	0	1	0	0	9.1	4.4	2.1	1	1
20	罗马	R-15	R-15-2-1	R-15-2-1-1	1	3	3	0	1	1	0	0	0	6.2	4.0	1.6	1	1
21	罗马	R-15	R-15-2-1	R-15-2-1-2	1	3	3	0	0	0	1	0	0	2.9	2.7	1.1	1	1
22	罗马	R-15	R-15-2-2	R-15-2-2-1	2	3	1	0	1	0	1	1	1	22.9	2.5	9.2	1	0
23	罗马	R-15	R-15-2-3	R-15-2-3-1	1	1	1	0	1	0	1	0	0	9.8	3.5	2.8	1	1
24	罗马	R-15	R-15-3-1	R-15-3-1-1	1	3	3	0	1	1	1	0	0	10.4	3.5	3.0	1	2
25	罗马	R-15	R-15-3-1	R-15-3-1-2	1	3	3	0	0	0	1	0	0	2.9	2.7	1.1	1	1
26	罗马	R-16	R-16-1-1	R-16-1-1-1	1	1	1	0	1	0	1	0	0	7.6	2.8	2.7	2	0
27	罗马	R-16	R-16-2-1	R-16-2-1-1	2	2	1	0	1	0	1	1	1	18.1	1.9	9.5	2	0
28	罗马	R-16	R-16-3-1	R-16-3-1-1	2	3	3	0	1	0	1	1	1	20.1	2.6	7.7	2	1
29	罗马	R-17	R-17-2-1	R-17-2-1-1	1	1	2	0	1	0	0	0	0	6.7	2.7	2.5	1	0
30	罗马	R-17	R-17-2-2	R-17-2-2-1	3	3	3	0	1	0	1	1	0	16.6	1.8	9.2	1	0
31	罗马	R-17	R-17-2-3	R-17-2-3-1	3	3	3	0	1	0	1	1	0	16.6	1.8	9.2	1	0
32	罗马	R-17	R-17-2-4	R-17-2-4-1	1	1	1	0	1	0	0	0	0	5.6	2.6	2.2	1	1
33	罗马	R-17	R-17-2-4	R-17-2-4-2	1	1	1	0	0	0	1	0	1	4.5	1.6	2.8	2	1
34	罗马	R-17	R-17-2-5	R-17-2-5-1	1	1	1	0	1	1	1	0	0	9.6	2.6	3.7	1	0
35	罗马	R-20	R-20-1-1	R-20-1-1-1	1	3	3	0	1	0	1	0	0	6.7	2.5	2.7	1	0
36	罗马	R-20	R-20-2-1	R-20-2-1-1	1	3	3	0	1	0	1	1	0	11.0	3.3	3.3	1	1
37	罗马	R-20	R-20-3-1	R-20-3-1-1	2	3	3	0	1	0	1	1	0	18.7	3.0	6.2	1	1
38	罗马	R-20	R-20-4-1	R-20-4-1-1	2	3	3	0	1	0	1	1	0	19.6	2.8	7.0	1	0
39	米兰	M-10	M-10-1-1	M-10-1-1-1	1	2	2	0	1	0	0	0	0	7.2	2.7	2.7	1	1
40	米兰	M-10	M-10-1-2	M-10-1-2-1	2	2	2	0	1	0	0	0	0	10.6	1.4	7.4	1	0
41	米兰	M-10	M-10-2-1	M-10-2-1-1	1	2	2	0	1	0	0	0	0	8.3	3.6	2.3	1	0
42	米兰	M-10	M-10-3-1	M-10-3-1-1	1	2	2	0	1	0	0	0	0	9.4	2.4	3.9	1	1
43	米兰	M-10	M-10-3-2	M-10-3-2-1	1	3	3	0	1	1	0	0	0	6.0	3.4	1.8	1	0
44	米兰	M-10	M-10-4-1	M-10-4-1-1	2	2	2	0	1	0	0	0	0	8.0	2.9	2.8	1	1
45	米兰	M-10	M-10-4-1	M-10-4-1-2	1	2	2	0	0	0	1	0	0	8.0	2.9	2.8	1	1
46	米兰	M-11	M-11-2-1	M-11-2-1-1	1	1	1	2	1	0	0	0	0	1.2	1.8	0.7	2	2
47	米兰	M-11	M-11-2-1	M-11-2-1-2	1	1	1	2	0	0	1	0	0	2.2	1.8	1.2	1	1
48	米兰	M-15	M-15-1-1	M-15-1-1-1	1	1	1	0	1	0	0	0	0	2.3	2.0	1.2	1	1
49	米兰	M-15	M-15-1-2	M-15-1-2-1	1	1	1	0	1	0	0	0	0	3.0	1.5	2.0	1	0
50	米兰	M-15	M-15-1-3	M-15-1-3-1	1	2	2	0	1	0	0	0	0	7.8	2.8	2.8	1	0
51	米兰	M-15	M-15-1-3	M-15-1-3-2	1	1	1	0	0	1	1	0	1	2.6	1.5	1.7	1	1
52	米兰	M-15	M-15-2-1	M-15-2-1-1	1	1	1	0	1	0	0	0	0	2.6	2.0	1.3	1	0
53	米兰	M-15	M-15-2-2	M-15-2-2-1	1	1	1	0	1	0	0	0	0	2.3	1.6	1.4	1	1
54	米兰	M-15	M-15-3-1	M-15-3-1-1	1	1	1	0	1	0	0	0	0	2.3	1.7	1.4	1	0
55	米兰	M-17	M-17-2-1	M-17-2-1-1	1	1	1	2	1	1	0	0	0	7.4	2.3	3.2	1	0
56	米兰	M-17	M-17-3-1	M-17-3-1-1	1	2	2	2	1	0	1	1	0	20.0	2.9	6.9	1	1
57	米兰	M-18	M-18-1-1	M-18-1-1-1	1	3	1	1	1	0	1	0	0	7.0	1.8	3.9	1	0
58	米兰	M-18	M-18-2-1	M-18-2-1-1	1	2	1	1	1	1	1	0	0	12.0	2.2	5.5	1	1
59	米兰	M-18	M-18-2-2	M-18-2-2-1	1	3	1	1	1	1	0	0	0	7.3	2.8	2.6	1	0
60	米兰	M-18	M-18-3-1	M-18-3-1-1	2	3	1	1	1	1	1	0	0	22.8	2.1	10.9	1	1
61	米兰	M-19	M-19-1-1	M-19-1-1-1	1	3	1	0	1	1	0	0	0	8.8	2.6	3.4	1	1
62	米兰	M-19	M-19-1-2	M-19-1-2-1	1	1	2	0	1	0	0	0	0	5.2	2.1	2.5	1	1
63	米兰	M-19	M-19-2-1	M-19-2-1-1	1	1	1	0	1	0	0	0	1	6.2	5.0	1.2	5	0
64	米兰	M-19	M-19-2-1	M-19-2-1-2	1	1	2	0	0	0	1	1	0	5.3	1.9	2.8	1	1
65	米兰	M-19	M-19-2-2	M-19-2-2-1	1	1	1	0	1	0	0	0	1	6.2	4.5	1.4	5	1
66	米兰	M-19	M-19-2-2	M-19-2-2-2	1	1	2	0	0	0	1	1	0	5.3	1.9	2.8	1	0
67	米兰	M-19	M-19-2-3	M-19-2-3-1	1	3	1	0	1	1	0	0	0	10.5	13.0	0.8	5	1
68	米兰	M-19	M-19-2-3	M-19-2-3-2	1	2	2	0	0	0	1	0	1	4.0	1.7	2.4	1	1

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69	米兰	M-19	M-19-2-4	M-19-2-4-1	1	3	1	0	1	1	0	0	0	4.0	5.6	0.7	5	2
70	米兰	M-19	M-19-2-4	M-19-2-4-2	1	2	2	0	0	0	1	0	1	4.0	1.7	2.4	1	1
71	米兰	M-19	M-19-2-5	M-19-2-5-1	1	3	3	0	1	0	0	0	1	4.5	11.2	0.4	5	0
72	米兰	M-19	M-19-2-5	M-19-2-5-2	1	1	1	0	0	0	1	1	0	3.6	1.6	2.3	1	1
73	米兰	M-19	M-19-2-6	M-19-2-6-1	1	1	1	0	1	0	0	0	1	4.2	5.0	0.8	5	1
74	米兰	M-19	M-19-2-6	M-19-2-6-2	1	1	1	0	0	0	1	1	0	3.3	1.6	2.1	1	0
75	米兰	M-19	M-19-2-7	M-19-2-7-1	1	1	1	0	1	0	0	0	1	12.4	3.2	3.9	1	1
76	米兰	M-19	M-19-2-7	M-19-2-7-2	1	1	2	0	0	0	1	0	0	4.8	3.3	1.5	1	0
77	米兰	M-19	M-19-2-8	M-19-2-8-1	1	1	1	0	1	0	1	0	1	12.4	3.2	3.9	1	1
78	米兰	M-19	M-19-2-8	M-19-2-8-2	1	1	2	0	0	0	1	0	0	7.3	3.0	2.4	1	0
79	米兰	M-19	M-19-2-9	M-19-2-9-1	1	1	1	0	1	0	1	0	1	12.4	3.2	3.9	1	1
80	米兰	M-19	M-19-2-9	M-19-2-9-2	1	1	2	0	0	0	1	0	0	5.0	1.9	2.6	1	1
81	米兰	M-19	M-19-2-10	M-19-2-10-1	1	1	1	0	1	1	0	0	0	4.3	5.6	0.8	5	1
82	米兰	M-19	M-19-2-10	M-19-2-10-2	1	1	1	0	0	0	1	0	1	4.0	1.7	2.4	1	0
83	米兰	M-19	M-19-2-11	M-19-2-11-1	1	3	1	0	1	1	0	0	0	3.9	5.6	0.7	5	1
84	米兰	M-19	M-19-2-11	M-19-2-11-2	1	1	1	0	0	0	1	0	1	4.0	1.7	2.4	1	1
85	米兰	M-19	M-19-3-1	M-19-3-1-1	1	1	1	0	1	1	1	0	0	12.4	3.2	3.9	5	0
86	米兰	M-19	M-19-3-1	M-19-3-1-2	1	1	2	0	0	0	1	0	1	4.7	2.0	2.4	1	1
87	米兰	M-19	M-19-3-1	M-19-3-1-3	1	1	2	0	0	0	1	0	0	2.6	2.0	1.3	1	0
88	米兰	M-19	M-19-3-2	M-19-3-2-1	1	3	1	0	1	1	0	0	0	4.0	4.6	0.9	5	0
89	米兰	M-19	M-19-3-2	M-19-3-2-2	1	2	2	0	1	0	0	0	0	4.0	1.5	2.7	1	1
90	米兰	M-19	M-19-3-2	M-19-3-2-3	1	1	1	0	0	1	1	0	0	3.3	2.0	1.7	1	1
91	米兰	M-25	M-25-1-1	M-25-1-1-1	1	2	2	1	1	0	0	0	0	6.0	2.6	2.3	1	1
92	米兰	M-25	M-25-3-1	M-25-3-1-1	1	3	1	2	1	0	1	0	1	14.7	2.8	5.2	1	0
93	米兰	M-25	M-25-3-1	M-25-3-1-2	1	1	1	1	0	0	1	0	1	10.0	2.0	5.0	2	0
94	米兰	M-27	M-27-1-1	M-27-1-1-1	1	3	2	0	1	0	0	0	0	5.2	1.5	3.5	1	1
95	米兰	M-27	M-27-1-2	M-27-1-2-1	1	1	2	0	1	0	0	0	0	3.0	1.7	1.8	1	1
96	米兰	M-27	M-27-2-1	M-27-2-1-1	1	3	2	0	1	0	0	0	0	5.1	1.4	3.6	1	0
97	米兰	M-27	M-27-2-2	M-27-2-2-1	1	1	2	0	1	0	0	0	0	4.3	1.9	2.3	1	1
98	米兰	M-27	M-27-3-1	M-27-3-1-1	1	1	2	0	1	1	0	0	0	6.0	1.4	4.3	1	0
99	米兰	M-29	M-29-1-1	M-29-1-1-1	1	1	1	0	1	0	1	0	0	7.6	2.4	3.2	1	1
100	米兰	M-29	M-29-1-2	M-29-1-2-1	1	1	1	0	1	1	1	0	0	11.4	2.2	5.2	1	1
101	米兰	M-29	M-29-1-3	M-29-1-3-1	1	1	1	0	1	1	0	0	0	6.6	2.5	2.6	1	0
102	米兰	M-29	M-29-2-1	M-29-2-1-1	1	1	1	0	1	0	0	0	0	3.2	2.5	1.3	1	1
103	米兰	M-29	M-29-2-2	M-29-2-2-1	1	1	1	0	1	1	0	0	0	7.6	2.1	3.6	1	2
104	米兰	M-29	M-29-2-3	M-29-2-3-1	1	1	1	0	1	0	0	0	0	5.2	2.5	2.1	1	1
105	米兰	M-29	M-29-2-4	M-29-2-4-1	1	1	1	0	1	1	0	0	0	5.9	2.5	2.4	1	1
106	米兰	M-29	M-29-2-5	M-29-2-5-1	1	1	1	0	1	0	0	0	0	3.3	2.5	1.3	1	0
107	米兰	M-29	M-29-2-6	M-29-2-6-1	1	1	1	0	1	0	0	0	0	4.4	2.5	1.8	1	1
108	米兰	M-29	M-29-2-7	M-29-2-7-1	1	1	1	0	1	1	0	0	0	7.5	2.0	3.8	1	1
109	米兰	M-29	M-29-2-8	M-29-2-8-1	1	1	1	0	1	1	1	1	1	16.3	1.8	9.1	1	0
110	米兰	M-29	M-29-3-1	M-29-3-1-1	1	1	1	0	1	0	0	0	0	4.5	2.5	1.8	1	1
111	米兰	M-29	M-29-3-2	M-29-3-2-1	1	1	1	0	1	0	0	0	0	4.4	2.4	1.8	1	0
112	米兰	M-33	M-33-2-1	M-33-2-1-1	1	3	2	1	1	0	0	0	0	5.3	2.5	2.1	1	1
113	米兰	M-36	M-36-1-1	M-36-1-1-1	1	1	1	1	1	1	0	0	0	9.6	2.4	4.0	1	0
114	米兰	M-36	M-36-2-1	M-36-2-1-1	1	1	1	1	1	1	0	0	0	5.6	2.5	2.2	1	1
115	米兰	M-36	M-36-3-1	M-36-3-1-1	2	1	1	1	1	0	1	1	1	19.5	2.4	8.1	1	0
116	米兰	M-38	M-38-3-1	M-38-3-1-1	1	3	1	1	1	1	1	0	0	13.8	3.1	4.5	1	1
117	米兰	M-39	M-39-1-1	M-39-1-1-1	1	1	1	0	1	0	1	0	0	11.9	2.5	4.8	1	1
118	米兰	M-39	M-39-2-1	M-39-2-1-1	2	1	1	0	1	0	1	1	1	26.3	1.5	17.5	1	0
119	米兰	M-41	M-41-1-1	M-41-1-1-1	1	1	1	0	1	0	0	0	0	5.3	2.6	2.0	1	0
120	米兰	M-45	M-45-2-1	M-45-2-1-1	1	2	1	0	0	1	0	0	0	2.8	1.2	2.3	2	0
121	米兰	M-45	M-45-2-2	M-45-2-2-1	1	1	1	0	0	0	0	0	1	1.2	1.6	0.8	2	1
122	米兰	M-45	M-45-2-3	M-45-2-3-1	1	1	1	0	0	0	0	0	1	1.1	1.6	0.7	2	1
123	米兰	M-49	M-49-2-1	M-49-2-1-1	1	1	1	0	1	1	1	0	0	9.3	2.2	4.2	1	1
124	米兰	M-49	M-49-2-1	M-49-2-1-2	1	3	3	0	1	0	0	0	0	3.6	1.8	2.0	1	0
125	米兰	M-49	M-49-2-2	M-49-2-2-1	1	1	1	0	1	0	0	0	0	5.5	2.7	2.0	1	0
126	米兰	M-49	M-49-2-2	M-49-2-2-2	1	3	3	0	0	1	1	0	0	4.0	2.5	1.6	1	0
127	米兰	M-50	M-50-1-1	M-50-1-1-1	1	2	1	2	1	0	1	0	1	9.2	1.7	5.4	1	0
128	米兰	M-50	M-50-2-1	M-50-2-1-1	1	3	3	2	1	1	0	0	0	7.9	3.2	2.5	1	0
129	米兰	M-50	M-50-2-1	M-50-2-1-2	1	2	2	1	0	0	1	1	1	8.6	2.2	3.9	1	1
130	米兰	M-50	M-50-3-1	M-50-3-1-1	1	3	3	2	1	0	0	0	0	9.4	3.3	2.8	1	0
131	米兰	M-50	M-50-3-1	M-50-3-1-2	1	2	2	1	0	0	1	1	1	10.0	2.3	4.3	1	1
132	都灵	T-2	T-2-1-1	T-2-1-1-1	1	3	3	0	1	0	0	0	0	4.2	1.5	2.8	1	0
133	都灵	T-2	T-2-1-2	T-2-1-2-1	1	3	3	0	1	0	0	0	0	3.8	2.0	1.9	1	1
134	都灵	T-2	T-2-1-2	T-2-1-2-2	1	3	3	0	0	0	1	0	0	3.9	1.9	2.1	1	0
135	都灵	T-2	T-2-1-3	T-2-1-3-1	1	3	3	0	1	0	0	0	0	3.9	1.6	2.4	1	1
136	都灵	T-2	T-2-1-4	T-2-1-4-1	1	3	2	0	1	0	0	0	0	3.9	1.6	2.4	1	0
137	都灵	T-2	T-2-1-5	T-2-1-5-1	1	1	2	0	1	0	1	0	0	7.0	1.5	4.7	1	1
138	都灵	T-2	T-2-1-6	T-2-1-6-1	1	3	3	0	1	0	0	0	0	3.9	1.9	2.1	1	0
139	都灵	T-2	T-2-1-6	T-2-1-6-2	1	3	3	0	0	0	1	0	0	2.9	1.8	1.6	1	1
140	都灵	T-2	T-2-1-7	T-2-1-7-1	1	3	1	0	1	0	1	0	1	7.5	2.0	3.8	1	1
141	都灵	T-2	T-2-1-8	T-2-1-8-1	1	1	1	0	1	0	1	0	0	7.4	1.6	4.6	1	0

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142	都灵	T-2	T-2-1-9	T-2-1-9-1	1	2	2	0	1	0	1	0	0	4.0	1.7	2.4	1	1
143	都灵	T-2	T-2-1-10	T-2-1-10-1	1	2	2	0	1	0	0	0	1	6.2	1.8	3.4	1	1
144	都灵	T-2	T-2-2-1	T-2-2-1-1	1	2	2	0	1	0	1	0	0	6.6	2.4	2.8	1	0
145	都灵	T-2	T-2-2-2	T-2-2-2-1	1	3	1	0	1	0	0	0	0	7.1	2.0	3.5	1	1
146	都灵	T-2	T-2-2-3	T-2-2-3-1	1	3	1	0	1	0	0	0	0	3.9	1.8	2.2	1	0
147	都灵	T-2	T-2-2-3	T-2-2-3-2	1	1	1	0	0	0	1	0	0	4.2	1.5	2.8	1	1
148	都灵	T-2	T-2-2-4	T-2-2-4-1	1	2	2	0	1	0	1	0	0	6.7	1.5	4.5	1	0
149	都灵	T-2	T-2-2-4	T-2-2-4-2	1	2	2	0	0	0	1	0	0	3.8	1.4	2.7	1	1
150	都灵	T-2	T-2-2-5	T-2-2-5-1	1	3	1	0	1	0	1	1	0	6.4	1.8	3.6	1	0
151	都灵	T-2	T-2-2-6	T-2-2-6-1	1	2	2	0	1	0	0	0	0	3.4	1.5	2.3	1	0
152	都灵	T-2	T-2-2-6	T-2-2-6-2	1	1	1	0	0	0	1	0	0	2.4	2.2	1.1	1	1
153	都灵	T-2	T-2-2-7	T-2-2-7-1	1	1	1	0	1	0	1	0	0	6.4	2.2	2.9	1	0
154	都灵	T-2	T-2-2-7	T-2-2-7-2	1	2	2	0	0	0	1	0	0	4.1	1.5	2.7	1	1
155	都灵	T-2	T-2-2-8	T-2-2-8-1	1	2	2	0	1	0	0	0	0	4.9	1.4	3.5	1	0
156	都灵	T-2	T-2-2-8	T-2-2-8-2	1	1	1	0	0	0	1	0	0	4.2	1.5	2.8	1	0
157	都灵	T-2	T-2-2-9	T-2-2-9-1	1	3	3	0	1	0	0	0	0	3.7	2.8	1.3	1	1
158	都灵	T-2	T-2-2-9	T-2-2-9-2	2	2	2	0	0	1	0	0	0	3.9	1.5	2.6	1	0
159	都灵	T-2	T-2-2-10	T-2-2-10-1	1	1	1	0	1	0	1	0	0	8.2	1.5	5.5	1	0
160	都灵	T-2	T-2-2-11	T-2-2-11-1	1	1	1	0	1	0	1	0	0	3.9	2.4	1.6	1	0
161	都灵	T-2	T-2-2-11	T-2-2-11-2	1	3	1	0	0	0	1	0	0	2.4	1.4	1.7	1	0
162	都灵	T-2	T-2-2-12	T-2-2-12-1	1	2	1	0	1	0	0	0	0	3.8	1.6	2.4	1	1
163	都灵	T-2	T-2-2-13	T-2-2-13-1	1	3	1	0	1	0	0	0	0	5.5	1.8	3.1	1	1
164	都灵	T-2	T-2-2-13	T-2-2-13-2	1	1	1	0	0	0	1	1	0	7.2	1.6	4.5	1	0
165	都灵	T-2	T-2-2-14	T-2-2-14-1	1	3	3	0	1	0	0	0	1	5.5	1.8	3.1	1	1
166	都灵	T-2	T-2-2-14	T-2-2-14-2	1	1	1	0	0	0	1	1	0	7.0	1.4	5.0	1	0
167	都灵	T-2	T-2-3-1	T-2-3-1-1	1	2	2	0	1	0	1	0	0	8.5	2.2	3.9	1	1
168	都灵	T-4	T-4-2-1	T-4-2-1-1	1	2	1	1	1	1	0	0	0	8.4	1.5	5.6	1	0
169	都灵	T-4	T-4-2-1	T-4-2-1-2	1	3	2	2	0	0	1	0	0	4.0	1.6	2.5	1	1
170	都灵	T-7	T-7-2-1	T-7-2-1-1	2	2	1	1	1	0	1	1	1	29.7	1.6	18.6	1	1
171	都灵	T-10	T-10-2-1	T-10-2-1-1	1	2	2	2	0	1	1	0	0	5.1	1.2	4.2	2	0
172	都灵	T-10	T-10-2-2	T-10-2-2-1	1	2	1	1	1	0	0	0	0	3.5	1.2	2.9	1	1
173	都灵	T-10	T-10-2-2	T-10-2-2-2	1	2	2	2	0	0	1	0	0	2.0	0.7	2.9	2	1
174	都灵	T-15	T-15-2-1	T-15-2-1-1	1	3	1	1	1	0	1	0	0	8.3	2.7	3.1	1	0
175	都灵	T-15	T-15-2-1	T-15-2-1-2	1	2	1	2	0	0	1	0	1	7.3	1.9	3.8	1	1
176	都灵	T-15	T-15-2-2	T-15-2-2-1	1	2	2	0	1	0	1	0	0	7.4	1.9	3.9	1	1
177	都灵	T-15	T-15-2-2	T-15-2-2-2	1	2	2	0	0	1	1	0	1	8.9	2.2	4.0	1	1
178	都灵	T-18	T-18-2-1	T-18-2-1-1	2	3	1	1	1	1	0	0	0	26.0	1.3	20.0	1	0
179	都灵	T-18	T-18-2-1	T-18-2-1-2	1	1	1	1	0	0	1	0	0	3.4	1.7	2.0	1	1
180	都灵	T-19	T-19-1-1	T-19-1-1-1	1	3	1	0	1	0	0	0	0	4.8	2.3	2.1	1	0
181	都灵	T-19	T-19-1-1	T-19-1-1-2	1	2	2	0	0	1	0	0	0	3.8	1.7	2.2	1	1
182	都灵	T-19	T-19-1-2	T-19-1-2-1	1	3	1	0	1	0	0	0	0	3.8	1.7	2.2	1	0
183	都灵	T-19	T-19-1-2	T-19-1-2-2	1	2	2	0	0	1	0	0	0	3.2	1.6	2.0	1	1
184	都灵	T-19	T-19-1-3	T-19-1-3-1	1	3	2	0	1	0	0	0	0	4.6	2.4	1.9	1	1
185	都灵	T-19	T-19-1-4	T-19-1-4-1	1	1	2	0	1	0	0	0	0	3.8	1.7	2.2	1	2
186	都灵	T-19	T-19-2-1	T-19-2-1-1	1	3	2	0	1	1	0	0	0	9.0	1.8	5.0	1	1
187	都灵	T-19	T-19-2-2	T-19-2-2-1	1	1	1	0	1	1	0	0	0	4.0	1.8	2.2	1	1
188	都灵	T-19	T-19-2-3	T-19-2-3-1	1	3	2	0	1	1	0	0	0	9.4	1.8	5.2	1	1
189	都灵	T-19	T-19-2-4	T-19-2-4-1	1	3	3	0	1	0	0	0	0	4.6	2.3	2.0	1	2
190	都灵	T-19	T-19-2-4	T-19-2-4-2	1	2	2	0	0	1	1	0	0	6.9	1.7	4.1	1	1
191	都灵	T-19	T-19-2-5	T-19-2-5-1	1	1	2	0	0	0	1	0	0	3.8	1.7	2.2	1	0
192	都灵	T-19	T-19-2-6	T-19-2-6-1	1	2	2	0	1	0	0	0	0	3.8	1.7	2.2	1	1
193	都灵	T-19	T-19-2-6	T-19-2-6-2	1	3	2	0	0	1	0	0	0	3.2	1.6	2.0	1	0
194	都灵	T-19	T-19-3-1	T-19-3-1-1	1	3	3	0	1	1	0	0	0	7.4	1.7	4.4	1	1
195	都灵	T-19	T-19-3-1	T-19-3-1-2	1	2	2	0	0	0	1	0	0	4.6	1.3	3.5	1	0
196	都灵	T-19	T-19-3-2	T-19-3-2-1	1	3	3	0	1	0	0	0	0	4.8	2.2	2.2	1	0
197	都灵	T-19	T-19-3-2	T-19-3-2-2	1	2	2	0	0	1	0	0	0	3.8	1.7	2.2	1	1
198	都灵	T-19	T-19-3-3	T-19-3-3-1	1	3	3	0	1	0	0	0	0	4.9	2.3	2.1	1	1
199	都灵	T-19	T-19-3-3	T-19-3-3-2	1	2	2	0	0	1	0	0	0	3.8	1.7	2.2	1	0
200	都灵	T-20	T-20-2-1	T-20-2-1-1	1	2	1	1	1	1	0	0	0	10.0	2.5	4.0	1	0
201	都灵	T-20	T-20-3-1	T-20-3-1-1	1	1	1	1	1	0	1	0	0	12.5	2.6	4.8	1	0
202	都灵	T-20	T-20-3-1	T-20-3-1-2	1	1	1	2	0	1	1	1	0	13.0	1.3	10.0	1	1
203	都灵	T-20	T-20-3-2	T-20-3-2-1	1	1	1	1	1	1	1	0	0	14.5	3.0	4.8	1	0
204	都灵	T-20	T-20-3-2	T-20-3-2-2	1	1	1	2	0	0	1	1	1	10.7	1.4	7.6	1	1
205	都灵	T-22	T-22-2-1	T-22-2-1-1	1	3	1	1	1	1	1	0	0	15.7	1.7	9.2	1	0
206	都灵	T-22	T-22-2-1	T-22-2-1-2	1	1	1	2	0	0	1	0	1	2.7	3.6	0.8	2	0
207	都灵	T-22	T-22-2-2	T-22-2-2-1	1	3	1	1	1	1	1	0	1	19.9	2.6	7.7	1	1
208	都灵	T-22	T-22-2-2	T-22-2-2-2	1	1	1	2	0	0	1	0	1	2.1	2.2	1.0	2	0
209	都灵	T-22	T-22-2-3	T-22-2-3-1	1	1	1	1	1	0	1	0	0	10.1	1.9	5.3	1	1
210	都灵	T-22	T-22-2-3	T-22-2-3-2	1	2	2	2	0	0	1	1	1	6.9	1.7	4.1	2	1
211	都灵	T-22	T-22-2-4	T-22-2-4-1	1	1	1	1	1	0	1	0	0	7.6	1.8	4.2	1	0
212	都灵	T-22	T-22-2-4	T-22-2-4-2	1	2	2	2	0	1	1	0	1	6.9	1.7	4.1	2	1
213	都灵	T-22	T-22-3-1	T-22-3-1-1	1	2	1	1	1	0	1	0	0	11.3	2.5	4.5	1	0
214	都灵	T-22	T-22-3-1	T-22-3-1-2	3	3	2	2	0	1	1	1	1	20.0	1.9	10.5	1	1

Appendix B Case Study Collection Data Code

(continued)

215	都灵	T-22	T-22-3-2	T-22-3-2-1	3	3	1	1	1	1	1	0	0	20.3	2.7	7.5	1	0
216	都灵	T-22	T-22-3-2	T-22-3-2-2	1	1	1	1	0	0	1	0	0	3.8	1.5	2.5	1	1
217	都灵	T-22	T-22-3-2	T-22-3-2-3	3	1	1	2	0	0	1	0	1	10.7	2.6	4.1	2	0
218	都灵	T-23	T-23-2-1	T-23-2-1-1	1	2	2	1	1	0	1	1	0	4.7	1.3	3.6	1	1
219	都灵	T-23	T-23-2-2	T-23-2-2-1	1	1	2	1	1	0	1	0	0	4.7	1.4	3.4	1	0
220	都灵	T-23	T-23-2-2	T-23-2-2-2	1	1	1	2	1	1	0	0	0	3.3	5.6	0.6	2	1
221	都灵	T-23	T-23-3-1	T-23-3-1-1	1	3	2	2	1	0	1	0	0	9.0	1.5	6.0	1	0

Acknowledgement

My seven years of architectural studies have flown by in the blink of an eye, and this thesis serves as a small footnote to that journey. It began with my interest in residential architecture, chronicles the fleeting year I spent studying abroad in Italy, and captures the flashes of insight sparked by discussions with my advisor. Whenever I open this document and wander through these familiar case studies, I feel as though I've returned to the sun-drenched Apennine Peninsula, walking into neighborhoods that ordinary tourists rarely venture into, raising my phone to photograph and research residential projects, and exchanging greetings with warm-hearted elderly ladies; I feel as though I've returned to the School of Architecture, stepping into that north-facing yet bright and cozy office, sitting at the computer with my advisor, organizing materials, selecting perspectives, building frameworks, refining structures, and polishing the language—improving with every iteration.

Now, I am about to bring these seven years to a close with this thesis. I would especially like to take this opportunity to thank everyone I have met at this university. It is your sincerity, care, mentorship, assistance, criticism, guidance, encouragement, and love that have made me a better person. I would particularly like to thank my advisor, Professor Cheng Xiaoqing. She values critical thinking and emphasizes holistic structure, nurturing my academic taste and research aspirations; she maintains a strong sense of responsibility and offers students deep care, inspiring me to keep exploring and moving forward; her humble and sincere demeanor has also set an example for me in how to conduct myself in life. During my exchange at the Polytechnic University of Turin, Professors Michele Bonino provided me with access to reference materials and research resources, while my senior classmate Jin Shuang and classmate Hu Murun also supplied me with some materials; I extend my gratitude to all of them here. I would like to thank all the wonderful and respected teachers who have imparted knowledge and guided me, as well as all my classmates who are embarking on the next chapter of life together. Finally, I would like to thank my fellow students in the research group for their encouragement and support, my roommates for their companionship and care, and my parents and family for their understanding and support. I would also like to thank all readers of this research.