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South China University of Technology

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基于形态准则的广州市元岗片区城市更新应用

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Application of Urban Renewal Design in Yuangang Area, Guangzhou Based on Form-Based Code

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摘要

本研究以广州市天河客运站北侧的元岗片区为研究对象，探讨形态准则（Form-Based Codes, FBCs）在城市更新中的应用。在中国城镇化进程逐步转向高质量发展的背景下，传统的粗放型发展模式已难以适应新时代需求，城市更新亟需更加精细化的设计方法和管控工具。形态准则作为一种以公共空间为核心、强调建筑形态与街道界面控制的规划方法，为城市更新提供了新的思路。

本文首先研究梳理了形态准则的理论发展历程，分析其在新城市主义思想下的起源、主要内容、核心思想及与中国现行体系对比的优势，阐明形态准则的理论价值。通过案例研究法，选取不同尺度、类型、组织原则的实践案例，总结形态准则在实践中的应用方法和实施路径。在梳理理论与案例的基础上，提炼出“全尺度的空间要素把握”与“城市层面形态要素理解”两大方法论，结合元岗片区的场地特征，从形态分区、廊道系统、开放与封闭空间等方面展开研究分析，识别场地特征与问题。基于上位规划目标，提出“服务于环五山创新策源区的创新创业融合区”的片区定位，构建以十四种形态分区取代功能分区的设计框架。生成形态分区导则、建筑类型导则、街道设计导则、开放空间导则等，以实现职住平衡、功能混合和空间品质提升的目标。

研究结果表明，形态准则以整体空间要素尺度出发，重视不同形态分区间的过渡，能够有效弥补传统控规在功能分区和形态管控上的不足，为城市一般地区的更新提供系统化、科学化的设计方法。本研究的创新点在于将形态准则本土化应用于城市复合型空间区域，探索其应用方法可行性和潜力，形成设计成果，为城市更新实践提供新的技术支持和理论参考。

关键词：形态准则；城市更新；元岗片区；新城市主义；精细化设计

Abstract

This study investigates the application of Form-Based Codes (FBCs) in the regeneration of the Yuangang area, north of Guangzhou's Tianhe Coach Terminal. Against the backdrop of China's shift toward high-quality urbanization, traditional extensive planning models are inadequate, requiring more refined tools. FBCs, emphasizing public space, building form, and street interfaces, offer new approaches to urban renewal.

This paper first reviews the theoretical development of FBCs, analyzing their origins under the New Urbanism movement, their main contents, core ideas, and comparative advantages over China's existing regulatory system, thereby clarifying their theoretical value. Through a case study approach, the research selects practical examples of different scales, types, and organizational principles to summarize the methods and implementation paths of FBCs in practice. On the basis of theory and case studies, two methodological insights are distilled: "grasping spatial elements across all scales" and "understanding form elements at the urban level." Combining these with the characteristics of the Yuangang site, the study examines Form district, corridor systems, and open versus enclosed spaces to identify site-specific features and issues. Based on higher-level planning objectives, the area is positioned as an "innovation and entrepreneurship integration zone serving the Wushan Innovation Source Area." A design framework is constructed to replace conventional functional zoning with fourteen form districts. Guidelines are then developed for form district, building typologies, street design, and open space, with the aim of achieving a balance of jobs and housing, mixed functions, and improved spatial quality.

Findings show that FBCs can complement traditional regulatory plans by integrating spatial form and functional control, providing systematic methods for ordinary urban areas. The study contributes by localizing FBCs in China's complex urban contexts and offering practical strategies for urban regeneration.

Keywords: Form-Based Codes; Urban Renewal; Yuangang Area; New Urbanism; Refined Design

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Chapter 1:Introduction

1.1 Research Background

1.1.1 Urban Development in the Stock-Based Era: Emerging Challenges

Since the mid-to-late 1990s, growth-oriented development has profoundly shaped urban strategies in China[1]. Real estate investment and land-based fiscal mechanisms became central drivers of economic expansion. By 2023, China's urbanization rate had reached 66.16%[2], signaling a transition from rapid expansion to a more stable, mature phase of urban development. In this context, the focus is shifting from large-scale new development to enhancing and optimizing existing urban areas. Urban design, accordingly, must pivot toward working within established land-use frameworks and focus on the refinement of smaller spatial units [3]. Unlike incremental planning, which is largely market-driven and often involves the redistribution of new benefits, planning in the stock-based era deals primarily with the built environment. It encompasses a wider range of interventions—from renovation and expansion to reconstruction and adaptive reuse of buildings [4]—and often requires more complex, multi-scalar approaches to implementation.

1.1.2 Limitations of Functional Zoning in Delivering High-Quality Urban Space

During rapid urbanization, regulatory detailed planning (RDP)has played a pivotal role in managing development intensity. As the legal basis for land transfer and project approval, RDP has been the primary tool for implementing the vision set forth in master plans. Urban design, positioned as a mechanism for shaping spatial form and urban character, has been closely tied to the RDP system. However, over the past two decades, RDP has remained largely focused on technical regulation—particularly development intensity—rather than qualitative spatial outcomes. Centered on rigid functional zoning, it emphasizes the segregation and clarity of land use types while often neglecting considerations of spatial morphology, mixed-use integration, and the character of the built environment. This approach has contributed to urban fragmentation and weakened street-level vibrancy, as excessive reliance on zoning has prioritized efficiency over livability. The absence of fine-grained design controls—such as those related to building interfaces, block structures, and public

realm design—has resulted in poor spatial quality that struggles to meet the increasingly diverse demands of urban residents.

1.1.3 Comprehensive Urban Renewal Areas Require New Modes of Regeneration

Since 2009, Guangzhou has actively promoted the "Three-Old Transformation", targeting the redevelopment of old villages, old factories, and old urban districts. To support this agenda, the city established dedicated bodies such as the Office for Three-Old Transformation and later, the Urban Renewal Bureau. These efforts have achieved notable progress. The core objectives of the policy include empowering the collective ownership of land to promote intensive and efficient land use, and revitalizing existing land stock to alleviate the supply-demand imbalance and support sustainable regional development.[5,6]

With the rapid pace of urbanization, many "Three-Old" areas have become closely integrated into the city and now form a vital part of the urban fabric. This research focuses on a comprehensive type of renewal area that includes elements of all three "old" types — villages, factories, and urban districts. Such areas are still widespread in Guangzhou today. These zones are typically located within walking distance of metro stations and enjoy favorable accessibility, well-developed commercial services, and extremely high population densities. The housing stock is largely rental-based, accommodating a significant transient population. However, these areas often suffer from poor spatial environments and degraded urban conditions. In such contexts, conventional demolition-and-reconstruction approaches are increasingly inadequate. Thus, new strategies for regeneration must be explored to address the complexities of these integrated urban renewal zones.

1.1.4 Unlocking the Potential of Ordinary Urban Areas

Urban design efforts in China have traditionally focused on high-profile areas—such as central business districts and flagship development zones—while overlooking the broader urban fabric. Since the 1990s, cities like Guangzhou and Shenzhen have pioneered district-level urban design frameworks (e.g., Zhujiang New Town, Futian CBD), gradually moving beyond site-level controls toward spatial strategies at the district scale. Meanwhile, most ordinary urban areas have remained under-regulated and peripheral to mainstream urban

design efforts[7]. *The Shanghai Specification for Regulatory Detailed Planning Outcomes (Trial Version, 2020)*proposed a citywide urban design control framework based on a "five-category, three-level"[8](Five Categories: public activity centers, key waterfront and scenic areas, transportation hubs, historical and cultural districts and other urban areas. Three Levels: Central Activity Zone (CAZ)and the core areas within sub-centers, as designated in the regulatory detailed planning; Designated areas within CAZs and sub-centers, and district-level centers; Community-level centers)classification of urban construction land. It expanded design control from key development zones to the entire territory of urban construction land, recognizing ordinary areas as foundational to the city’s spatial structure and integrating them into a comprehensive control strategy.

The Recommendations of the Central Committee of the Communist Party of China for the Formulation of the 14th Five-Year Plan and the Long-Range Goals for 2035 clearly articulate urban renewal as a national priority. Urban renewal is positioned not only as a response to changing development dynamics, but also as a key pathway to fostering high-quality urban growth, expanding domestic demand, and advancing a new development paradigm[9,10]. Given their extensive coverage, large stock of built assets, and close proximity to everyday life, ordinary urban areas hold immense potential for sustainable regeneration and should become a primary focus in the next stage of stock-based urban development.

1.2 Origins of the Research

1.2.1 Urban Fringe in History

The study area is located in the Yuangang District, north of the Tianhe Coach Terminal in Guangzhou. The site is bounded by Zhongcheng Road to the north, Shatai North Road and the Shahe Canal to the west, Tianyuan Road to the east, and the Guangzhou Ring Expressway to the south. The area’s earliest development can be traced back to the villages of ShangYuangang and XiaYuangang, with origins dating to the Yuan Dynasty. By the 1930s, Yuangang had become the northeasternmost village of Guangzhou. At that time, a boundary stone inscribed with "City Limits of Guangzhou" was erected on the edge of the village, as shown in the image below.



Figure1- 2 Location Map of the Study Area
(Source: author's own drawing)



Figure1- 3 Present Condition of the Boundary Stone
(Source: Author's own drawing)

From the perspective of Guangzhou's current urban structure, the Yuangang area has evolved into an important urban district. However, historically, it belonged to what is referred to as the "urban fringe". In a narrow sense, the term "urban fringe" refers to the city-country fringe, also known as the urban-rural transitional zone, zone of urban influence, or outer suburban zone. It denotes the interface between urban and rural land, typically situated on the edge of the built-up area or within the transition belt between the city center and the distant suburbs[11].

Guangzhou's urban spatial structure remained relatively stable until the 1960s. Starting in the 1970s, urban growth began to expand eastward, and by the 1980s, rapid outward expansion took place. By the late 1990s, a vast and continuous urban area had taken shape, giving rise to urban sprawl[12]. Before the 1980s, Yuangang was still a rural area located far from the city center. A satellite image from 1983 shows that the site consisted mainly of village settlements and a few schools, while the surrounding land remained agricultural or otherwise undeveloped. Since the 1980s and 1990s, however, Yuangang has gradually become part of the city's suburban expansion zone. Today, it features a highly complex spatial structure where urban villages, factory compounds, residential neighborhoods, and danwei coexist side by side.

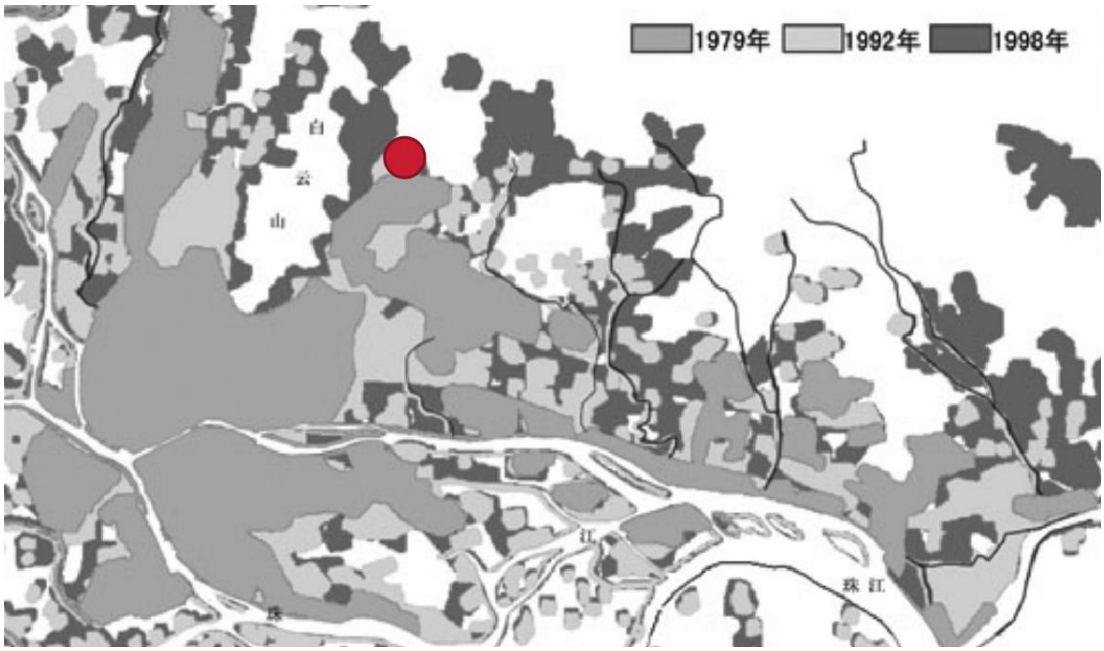


Figure1- 4 Urban Expansion of Guangzhou, 1978 – 1998
(Source: Reference[12])

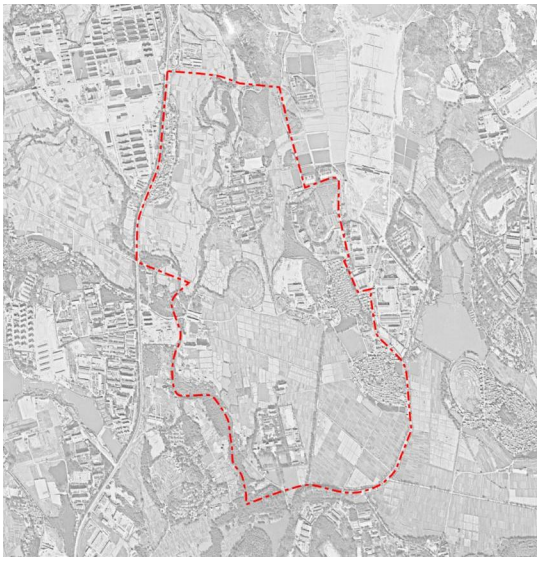


Figure1- 5 Historical Aerial Image, 1983
(Source: https://earthexplorer.usgs.gov/)

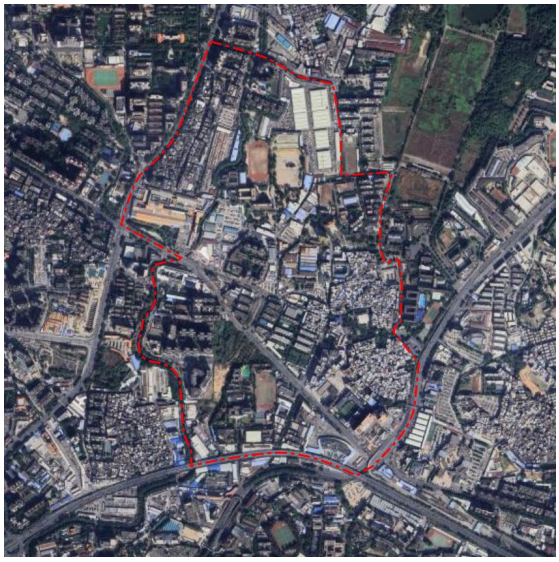


Figure1- 6 Satellite Image, 2024
(Source:Google Map)

1.2.2 A Hybrid Urban District Integrating the "Three-Olds"

Following the reform and opening-up period, the rapid expansion of Guangzhou significantly strengthened the connection between the Yuangang area and the urban core. By the 1990s, Yuangang began to develop a tertiary industry, with the emergence of commercial shops, factory buildings, warehouses, farmers' markets, and land leasing businesses—such as auto parts markets and parking lots. Yuangang Village also partnered with external

organizations to jointly establish enterprises, opening up a new path for local economic development.[13]During this period, the built-up area of Yuangang continued to expand, gradually forming a spatial structure characterized by the coexistence of urban villages, industrial zones, and urban development areas—a typical hybrid morphology of cities.

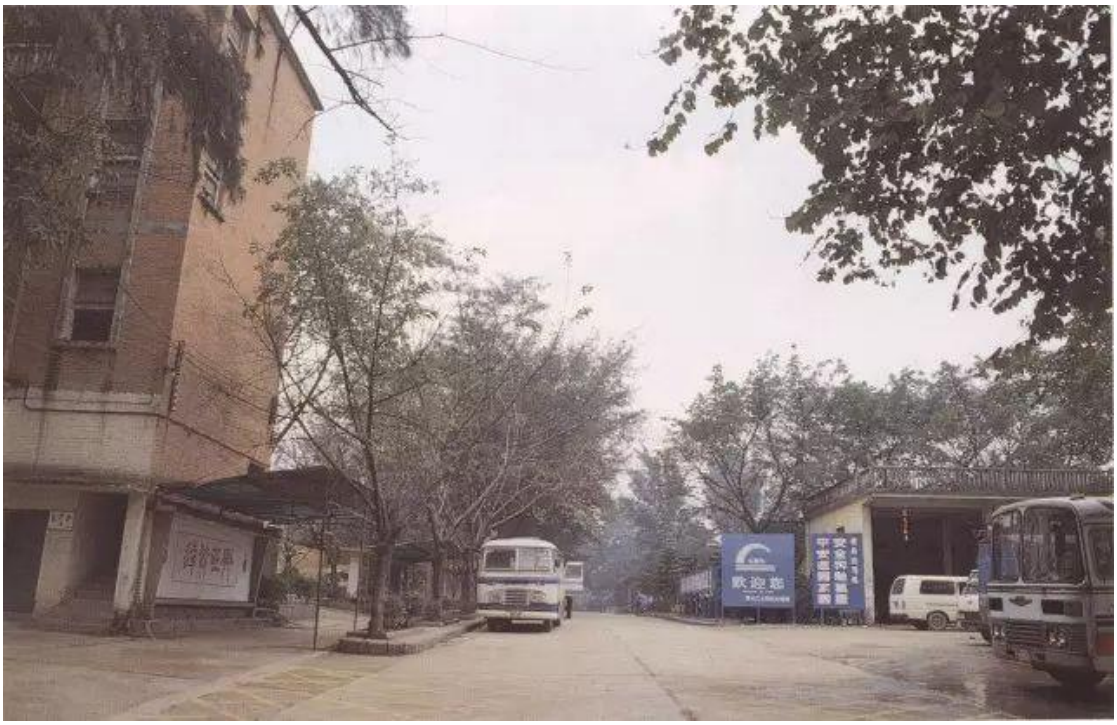


Figure1- 7 Guangzhou Plumbing Equipment General Factory, located in Shang Yuangang in the 1990s

(Source: https://mp.weixin.qq.com/s/dkG46xfFwe81xjbwh5gLQw)

At the end of 2024, the Guangzhou Municipal Government Work Report proposed leveraging the Wushan scientific research and higher education hub to develop an Innovation Source Zone around Wushan, aiming to promote industrial upgrading and urban village regeneration.[14] In March 2025, the regulatory detailed plan for the first phase of Yuangang Village's renewal project was officially released, outlining the designated redevelopment boundaries.[15]



Figure1- 8 Boundary of Phase I of the Yuangang Village Renewal Project and the Shang Yuangang Plot (Source: People’ s Government of Tianhe District, Guangzhou)

1.3 Research Objectives and Significance

1.3.1 Research Objectives

This study aims to explore urban form design strategies within the context of high-quality urban renewal, by drawing upon the theory and practice of Form-Based Codes (FBCs)—an urban design regulatory tool developed in the United States.

The research seeks to: Interpret the structure, implementation pathway, and design methodology of the FBC framework; Expand theoretical understanding of FBCs; Identify their core strengths in regulating spatial form; Explore potential strategies for local adaptation

and application in the Chinese context. A further objective is to test the application of FBC principles through design practice on specific urban blocks, and to propose localized design strategies that respond to the complex demands of urban regeneration in China.

1.3.2 Research Significance

As urban renewal in China transitions toward high-quality development, public expectations for spatial quality have grown significantly. This research introduces Form-Based Codes as a means to address the limitations of traditional regulatory planning in controlling urban form, thereby injecting new vitality into urban planning theory. By localizing the FBC framework and adapting its methods to suit the Chinese context, this study seeks to enrich the design approaches for hybrid urban districts, and contribute new perspectives to the evolving discourse on urban regeneration strategies and implementation pathways.

1.4 Related Concepts

1.4.1 Two Development Models Under the New Urbanism Paradigm

In response to widespread urban sprawl, New Urbanism emerged as a reflective planning movement. At its core, it advocates for "the revitalization of existing town and city centers, and the reconfiguration of sprawling suburban areas into diverse, authentic neighborhoods[16,17]".

Broadly speaking, New Urbanism seeks to restore traditional neighborhood scales, promote functional integration, walkability, and compact, complete communities across urban, suburban, and rural contexts. Under this paradigm, two main development models have become systematized:

(1) Traditional Neighborhood Development (TND):

Proposed by Andrés Duany and Elizabeth Plater-Zyberk, TND draws upon Clarence Perry’s "neighborhood unit" theory from the 1930s, integrating the key elements of neighborhoods, districts, and corridors. It is grounded in traditional urban and town design principles, typological analysis, and architectural language. TND seeks to reshape the spatial logic of urban neighborhoods, breaking away from modernist functional zoning in favor of

traditional community structures that emphasize sociability, local identity, and human-scale environments[17].

Spatial Structure: TND advocates a five-minute walking radius (approximately 400 meters)as the basic neighborhood unit. Public buildings such as schools, shops, transit stops, and plazas are located at the neighborhood center to ensure accessibility.

Street Network: A pedestrian-prioritized, hierarchical street grid is encouraged—comprising arterials, minor streets, and alleys. Cul-de-sacs are avoided. Streets are designed to reduce vehicle speeds through narrower widths and tight curb radii, and are enhanced with programmatic diversity to create vibrant, place-based streetscapes.

Mixed Use: A diversity of housing types—including detached houses, rowhouses, apartments, and accessory dwellings — is incorporated to accommodate varying income groups and promote social diversity. Public spaces are interwoven throughout to foster interaction, civic life, and a sense of place.

(2) Transit-Oriented Development (TOD)

Developed by Peter Calthorpe, TOD is a model of compact, mixed-use urban development centered around regional transit stations. Urban functions are concentrated within the walkable radius of a transit node, creating high-density, transit-served communities that reduce automobile dependency and limit urban sprawl while preserving the natural environment. TOD can be scaled to city centers, neighborhood hubs, or secondary development zones.

Spatial Structure: Transit stations form the core of development, with urban facilities distributed within a five-minute walk. Public spaces are preserved and positioned at key sites such as transit plazas or civic centers.

Street Network: A pedestrian-friendly street system is emphasized, ensuring strong connectivity and accessibility between transit stations and residents' destinations.

High-Density, Mixed-Use Development: The model promotes high-density, mixed-use buildings and a gradient of housing types to serve diverse populations while maintaining ecological sensitivity. City-scale TODs feature dense commercial zones or medium-density housing near stations; neighborhood-scale TODs combine housing, retail, and public amenities along a main street. Secondary areas follow the same model at a reduced intensity.

TND and TOD share several fundamental principles: clearly defined edges and centers, walkability, transit-oriented mobility, and a strong emphasis on public space and placemaking. Their key differences lie in orientation and theoretical lineage: TND draws heavily on European urban typologies and emphasizes architectural form and fine-grain detailing. TOD, by contrast, is infrastructure-centered, using transit stations as organizing anchors for urban form.

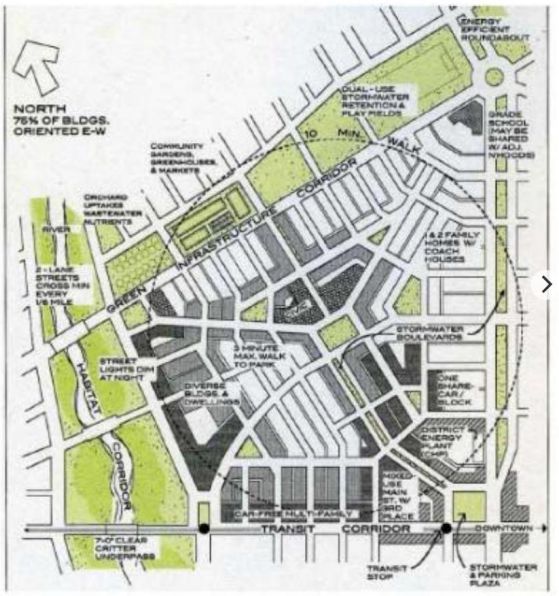


Figure1-9 TND Development Model Diagram

(Source:reference[18])

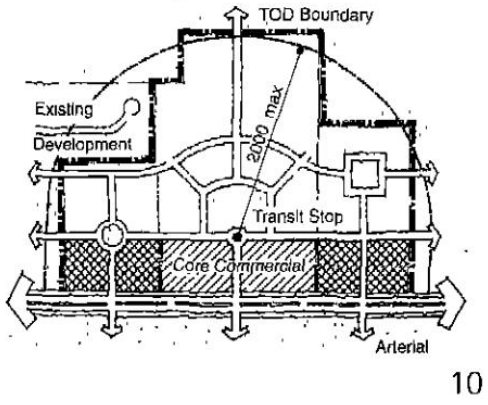


Figure1- 10 TOD Development Model Illustration

(Source:reference[18])

1.4.2 The SmartCode and the Transect-Based Planning Method

The transect is a foundational concept in form-based urban design, serving as a critical framework for organizing spatial form across multiple scales. This idea draws inspiration from geography and ecology. The earliest known transect diagram was created in 1793 by Alexander von Humboldt, depicting the distribution of ecosystems and modes of production across geographical space and geological time in the Patagonian region. However, his representation did not explicitly relate these production systems to human settlements. A more socially grounded application came from Scottish sociologist and planner Patrick Geddes, whose "Valley Section" diagram illustrated the continuum from mountains to coastline. This section was among the first to connect natural landscapes with human habitation and is considered a pioneering use of transects in design disciplines.[19]Later, the

landscape architect Ian McHarg, in Design with Nature, and architect Christopher Alexander, in *The Pattern Language*, also used transect-based diagrams to represent ecological zones—for example, from beach to inland bay—employing section drawings as tools to express design ideas and methodological principles (Figure 1-3).These works marked the translation of ecological transect thinking into the realm of spatial design.

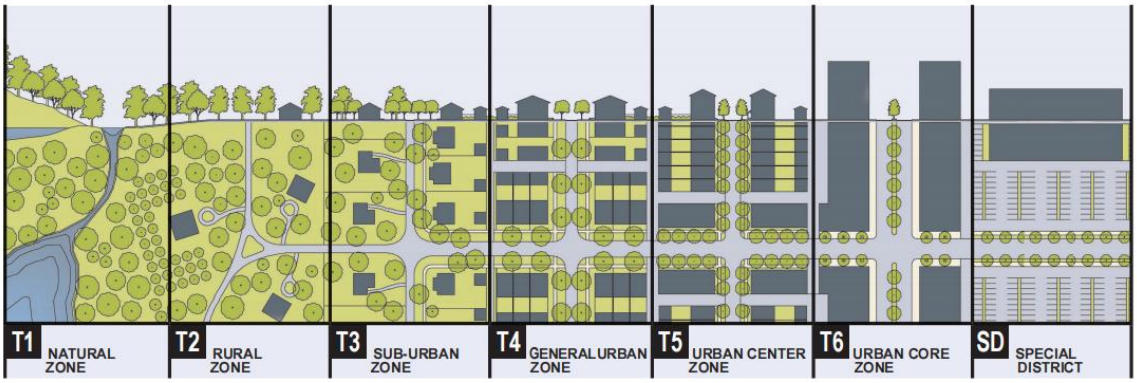


Figure1- 11 Typical "rural - urban" section and section zoning
(Source:Refference[20])

Building upon these ecological concepts, Andrés Duany and Elizabeth Plater-Zyberk (collectively known as DPZ)developed a transect-based urban planning theory, which was formally elaborated in their 1999 publication *The Lexicon of the New Urbanism*, and later codified in 2003 as the SmartCode—a regulatory framework that operationalizes transect principles into design practice.

(1) Core Concepts

At the heart of transect-based planning is the Rural-to-Urban Transect, a conceptual continuum of spatial zones that progress from natural landscapes to urban cores (e.g., Natural Zone → Rural Zone → Suburban Zone → General Urban Zone → Urban Center). This model expresses a gradient of urbanization, providing a spatial logic for place-based development.

Integrated Spatial Governance: The transect framework establishes a multi-scalar regulatory system across regional, neighborhood, and street levels. It emphasizes alignment with local ecological and cultural contexts, ensuring that development intensity and form match the character of each transect zone. This helps prevent overdevelopment in rural areas

and inefficient sprawl in urban peripheries — a problem often referred to as "rural-urban spatial mismatch".

Compact Development: The model encourages infill development, adaptive reuse of sites around transit stations, and higher-density growth in appropriate urban areas, supporting compact, transit-friendly, and resource-efficient city forms.

Form-Based Orientation: Each transect zone is defined by a coherent set of physical form elements — including building typologies, lot configurations, land uses, street design, infrastructure, and vegetation. This system replaces conventional use-based zoning with a more holistic approach that coordinates all spatial components to create cohesive urban environments.

(2) Application Tool: The SmartCode

The SmartCode is a comprehensive form-based coding system derived from transect theory. It integrates the principles of Smart Growth and New Urbanism, emphasizing spatial form over land-use functions. It functions as a toolbox of urban design codes, comprising a range of regulatory components such as: Building Standards, Building Type Guidelines, Frontage Type Regulations, Civic Space Standards, etc. These elements can be flexibly applied across planning scales—regional, district, neighborhood, or site-specific—to implement spatial order and preserve contextual character. The SmartCode supports place-specific governance by offering adaptable templates that guide development in harmony with ecological gradients and urban intensity.

1.5 Literature Review on Related Research at China and Abroad

Research on Form-Based Codes (FBCs)has undergone notable evolution — from the establishment of theoretical frameworks to empirical application; from dominant use in North America to broader international adoption; and from foundational studies to a diverse spectrum of real-world case analyses.

1.5.1 International Research Review

(1)From Transect Theory to Form-Based Codes: Cross-Disciplinary Theoretical Integration

The SmartCode, published by Duany Plater-Zyberk (DPZ)in 2003, represents a universal regulatory system grounded in the transect model, integrating principles of Smart Growth and

New Urbanism.[4]The transect framework promotes the creation of immersive built environments that transition naturally along the rural-to-urban spectrum, forming the theoretical foundation of form-based regulation.

Form-Based Codes, as a design control mechanism, emerged from practical application and were continuously refined through implementation. International scholars have explored transect theory extensively. Andrés Duany and Emily Talen traced the intellectual lineage of transect theory from ecological science to urban spatial design, interpreting it as an effort to organize environmental components in a way that is context-sensitive and immersive.[21]They emphasized that the transect enables the creation of place-specific experiences by structuring spatial elements in alignment with the character of each locale.[21]Emily Talen further deepened the theoretical foundation of FBCs. In her paper *Design by the Rules: The Historical Underpinnings of Form-Based Codes*, she systematically examined the historical roots of form-based planning, arguing that the concept of regulating urban form is not new—it dates back over 3,000 years. Talen views FBCs as both an inheritance and innovation of historical design traditions, proposing that they serve as a morphology-driven planning tool for future zoning reform. Talen also described the transect as not merely a technical instrument but a philosophical framework capable of addressing long-term urban issues such as poor density distribution and functional fragmentation.[22]She identified five key dimensions where FBCs demonstrate design advantages: pattern, scale, homogeneity, separation, and enclosure, providing a theoretical basis for resisting urban sprawl.

Other researchers have explored the transect model as an analytical tool. For example: Timotheus Klein and Sebastian Clausen applied the transect method to study major roads(Magistralen)in Hamburg, Germany, analyzing spatial rhythms of land use and socioeconomic patterns to demonstrate the multidimensional utility of the transect in urban planning.[23]Magdalena Wiśniewsk examined the potential and challenges of applying FBCs in the revitalization of historic urban centers in Poland. She argued that while the FBC methodology is universally applicable for spatial design, it requires contextual adaptation to local legal and cultural conditions in order to balance tradition and modernity.[24]SaMin Han explored the use of the transect-based planning model in enhancing urban resilience, especially in terms of climate adaptation and landscape sustainability, and elaborated its

evolution as a responsive design strategy for managing environmental uncertainty.[25]

(2)Evaluating the Effectiveness of Form-Based Codes: Quantitative and Qualitative Assessments

Over the past decade, a growing body of research has sought to assess the implementation outcomes of FBCs through empirical studies. Scholars such as Ajay Garde and Cecilia Kim have conducted comparative evaluations of FBCs using the LEED-ND framework. Their methodology employed Weighted Consistency Scores (W)to measure how comprehensively FBCs align with LEED-ND standards. Case studies included cities like Miami and Denver, comparing the impact of FBCs versus conventional zoning codes.[26] They later expanded their research across 26 Southern California cities, comparing 13 cities using FBCs (e.g., Ventura, Santa Ana)with 13 using traditional zoning. Their findings revealed that while FBCs do not always outperform conventional codes in all metrics, they generally scored higher in terms of integrating sustainability standards and spatial coherence.[27]

In another study, Jae Teuk Chin analyzed the case of St. Louis, comparing land values before and after FBC implementation. Results showed that FBCs can enhance the value of non-residential properties, such as commercial sites, though the impact on residential investment was less pronounced.[28] In 2021, Emily Talen conducted a large-scale quantitative study, comparing 274 FBC-based areas with 36,685 non-FBC zones across the U.S. She assessed FBCs' performance across three dimensions: equity, density, and diversity. The findings confirmed that FBCs are particularly effective in encouraging diverse housing types and higher-density development, especially in suburban contexts.[29]

(3) The Globalization of Form-Based Codes: Non-American Paradigm Shifts

In the past five years, the reach of FBCs has expanded beyond the United States to Europe, the Middle East, and Southeast Asia, prompting international scholars to explore their localized applications. These studies examined the adaptability of form-based strategies in varied contexts, such as historic districts, high-density Asian urban areas, and culturally sensitive redevelopment zones. These international efforts demonstrate the flexibility and scalability of FBCs. While they originate from a distinctly American planning tradition, their

core principles — such as morphology-driven design, spatial hierarchy, and human-scale development—resonate globally, offering a valuable toolkit for diverse urban challenges.

Table1- 1 The main research conclusions of foreign scholars

(Source:by the author)

Scholar(s)	Application Area	Key Findings
Kejt Dhrami[30]	Shkodër (Albania)	Verified that FBCs can address issues of informal expansion and rigid zoning regulations, but must be adapted to transitional land governance systems
Bartosz Kaźmierczak[31]	Białystok (Poland)	FBCs supplement statutory planning by providing clear definitions of "architectural aesthetics", helping to balance historic preservation with contemporary development needs
Ye Zhang et al[32].	Singapore	Developed the first FBC model for tropical high-density cities, demonstrating significant improvements in walkability (+32% walking efficiency), functional mix, and block density
Kanokwan Masuwan et al.[33]	Phuket (Thailand)	When used as a complement to traditional zoning, FBCs effectively preserved the cultural characteristics of historic streets and increased street vitality (visitor dwell time increased by 25%)
Jacob Marley Howard[34]	Saratoga Springs (USA)	Multiple regression analysis confirmed that FBC implementation led to an 18% increase in property tax revenue and a 12% increase in sales tax
Faisal Fahad Bin Sulaiman et al.[35]	Saudi Arabia	FBCs enhance sociocultural value through four dimensions: privacy, safety, social interaction, and architectural identity—addressing gaps in conventional codes
Samaa Badawi et al.[36]	Jeddah – Kabel Street (Saudi Arabia)	Provided a systematic solution for historic district regeneration by combining flexible building control with public participation mechanisms, reducing restoration costs by 30%
Ghorbanian[37]	theoretical comparative studies	FBCs are more responsive to contemporary urban needs than Euclidean zoning, and more effective at curbing urban sprawl (case studies showed a 15% increase in public space allocation)

1.5.2 Research Review in China

(1)Re-contextualizing Form-Based Codes and Related Theories

As Form-Based Codes (FBCs)only began gaining attention in China in the past decade, relevant academic studies are still in an early developmental stage. Since 2011, Chinese scholars have increasingly focused on this topic, with early studies primarily introducing the structure and content of FBCs—including the SmartCode—and proposing potential avenues for adaptation in China. A foundational Chinese translation of *Form-Based Codes* by Parolek et al., translated by Wang Xiaochuan and others, represents the first systematic presentation of FBCs in China, detailing its regulatory framework and practical application methods[38]. Later, Qi Dongjin and Zhou Jianyun (2013)provided a comprehensive introduction to urban form-based design codes. They emphasized how the Rural-to-Urban Transect draws from ecological principles, and explained the core concepts, primary components, and fields of application for FBCs. They argued that FBCs use a typological method to translate sustainability values into form-based design, which—through public participation—can build social consensus and facilitate regulatory implementation in urban design.[39]Subsequent studies have continued to expand this theoretical base. Zhou Zhongkai and others conducted further research on transect theory, examining the conceptual foundations and analytical methods of transect diagrams. They analyzed the compositional elements, typologies, representational formats, and operative mechanisms of transects, and discussed their value in design governance and practical planning, offering insights for China’s urban design development.[19]

Zhang Zhengtao and colleagues reviewed New Urbanism, SmartCode, and related urban form control tools, analyzing the development and interconnections of these tools in the U.S.,while also offering recommendations for improving urban form control mechanisms in China.[17]Dai Jian and others outlined the developmental trajectory of FBCs and distilled key principles from multiscale case studies.[40]Building upon this, Zhou Enbo further explored the evolving and constant aspects of FBC theory and techniques. He emphasized how the robust theoretical foundation and flexible logic of FBCs could offer meaningful guidance for China's future regulatory planning frameworks.[41]

(2)Localized Application of Form-Based Codes in China

In parallel with theoretical research, some scholars have attempted to apply FBCs in actual design processes, particularly in contexts such as historical districts and urban renewal in older neighborhoods. In 2018, Kong Weiyuan and Dang Sheng applied FBC principles to a small city — Qianxi County in Tangshan — using the transect concept to guide spatial organization by defining various street interface types, such as residential, commercial, traffic-oriented, plaza, and park frontages.[42]

Following this, Chen Rushuang and Zhao Miaoxi (2019)applied urban design-based FBC methods to the historical Renminnan district in Guangzhou. They began with form-based zoning and adopted a "micro-renewal" approach, establishing guiding standards for land use, overall building form, building typologies, and street frontages.[43] Qi Dongjin, Zhou Jianyun, and colleagues later used transect planning methods to analyze the urban morphology of the southern section of Guangzhou’s New Central Axis. Their urban design proposal divided the area into 7 form-based zones using regulatory planning and drafted corresponding codes to guide the urban renewal process.[4]

Xiao Jingtong (2022)further explored the integration of FBCs with China’s statutory planning system in a study on the application of FBCs in detailed regulatory plans. She proposed five practical application paths: "independent zoning", "composite zoning", "overlapping zoning", "floating zoning", and "design guidelines". Her study, based on the Guangzhou–Foshan Jinshazhou area, contributed valuable experience in applying FBCs to large-scale, mixed urban–rural territories.[44]

Overall, academic discourse in China surrounding FBCs has been moving toward increasing depth and localization. Theoretical introductions are becoming more comprehensive, the evolution of FBC-related theories is being clarified, and research has transitioned from conceptual discussion to practice-based exploration. Moreover, scholars are increasingly focused on implementation strategies, signaling a shift from FBCs as mere design control tools to integrated planning mechanisms within the Chinese urban context.

1.6 Research Methodology

This study adopts a comprehensive methodological approach by integrating literature review, case study, comparative analysis, and empirical research to explore the theoretical foundation

and practical application of Form-Based Codes (FBCs)in the context of urban regeneration. The specific methods are as follows:

1.6.1 Literature Research Method

A systematic review of domestic and international literature on the origins, evolution, and current status of Form-Based Codes is conducted to understand the theoretical lineage and provide a basis for refining the conceptual framework.

Key steps include collecting academic papers, monographs, and policy documents related to FBCs; analyzing the theoretical foundations, core concepts, and development trajectories; and evaluating the strengths and limitations of existing studies. This review forms a theoretical basis for localizing FBCs to better fit the needs of urban regeneration in China.

1.6.2 Case Study Method

Representative cases of FBC implementation—both domestic and international—are selected to analyze their context, objectives, design methodologies, and implementation outcomes. By extracting the successful practices and identifying shortcomings within these cases, transferable design strategies and implementation pathways are summarized. These provide practical reference for subsequent empirical studies and enrich the contextual applicability of FBCs.

1.6.3 Comparative Analysis Method

Compare the similarities and differences between Form-Based Codes and the domestic control planning system, and understand the theoretical advantages of the FBCs. Compare the design methods, implementation paths, and outcomes of the case studies, summarizing the commonalities and differences. Through comparative analysis, improve existing theoretical and practical research, and propose specific strategies for the localization of FBCs in China.

1.6.4 Empirical Research Method

An empirical application of FBCs is conducted in the Yuangang district to assess their applicability within complex urban contexts in China. The existing spatial conditions of the research area—including spatial quality, functional distribution, and form structure—are analyzed. Based on the theoretical framework of FBCs, targeted design strategies are

proposed, such as public space optimization, building form regulation, and functional integration. Through on-site investigation and design practice, the feasibility and effectiveness of FBCs are tested in real-world scenarios.

This contributes a practical, localized case to the discourse on urban regeneration in China and demonstrates the operational value of FBCs in complex urban environments.

1.7 Research framework

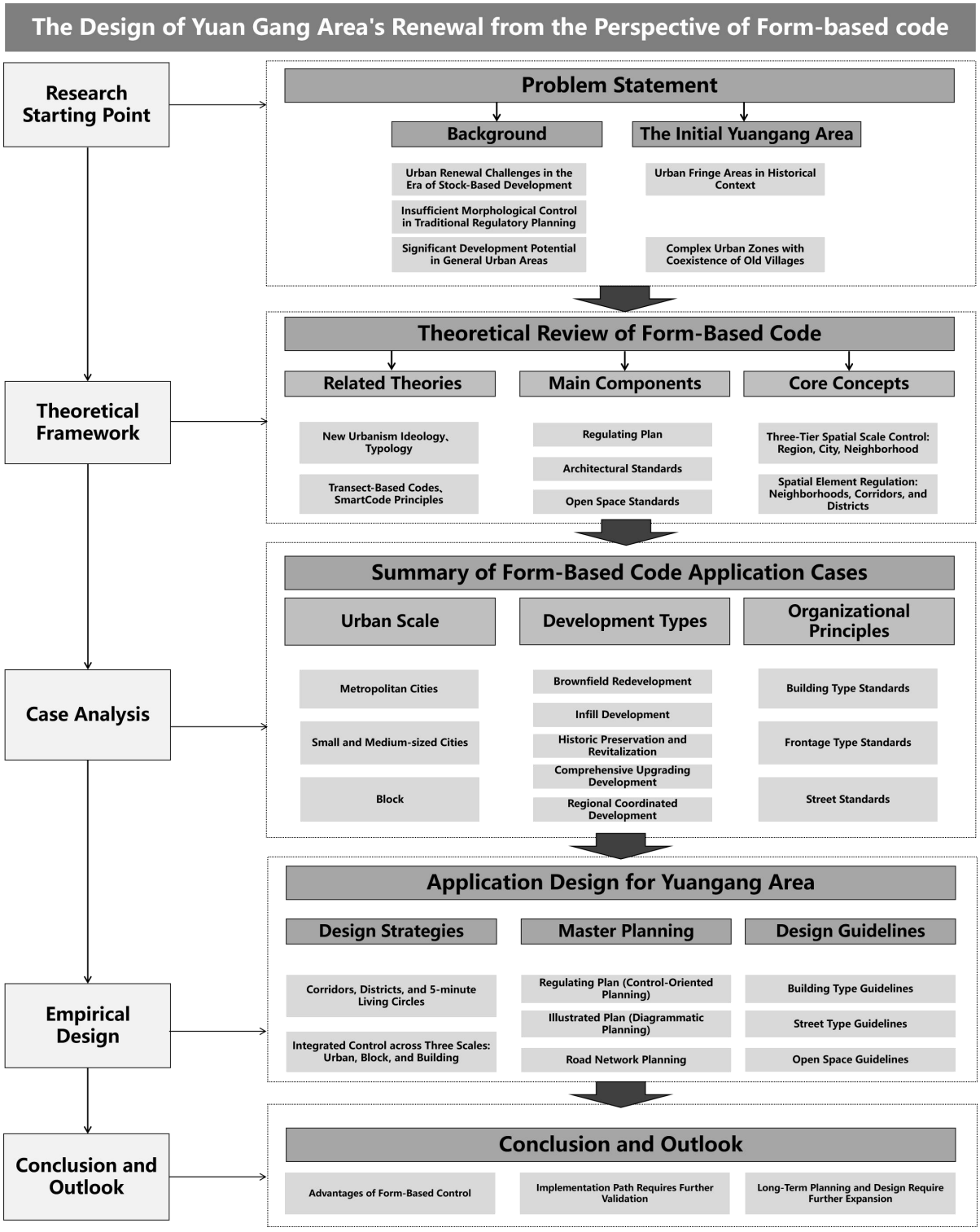


Figure1- 12 Research framework

(Source:by the author)

Chapter2:Theoretical Overview of Form-Based Codes

2.1 Development History of Form-Based Codes

Form-Based Codes (FBCs)originated as a response to the phenomenon of urban sprawl after World War II. Both the public and planners began reflecting on the limitations of traditional zoning systems and sought new urban design approaches to counteract sprawl. Among these, the most representative ideology was New Urbanism. The planning of Seaside, Florida is widely recognized as the most successful early case and considered the prototype of FBCs. As New Urbanism matured, the transect planning theory was introduced, further refining the theoretical foundation of Form-Based Codes. Today, FBCs have been widely applied and are increasingly adopted as an alternative to conventional zoning regulations.

2.1.1 Origins and Background of Form-Based Codes

(1)Urban Sprawl

Form-Based Codes emerged as a response to the challenges posed by post-war urban sprawl. In Western contexts, urban sprawl refers to “an abnormal form of low-density urban expansion, in which agricultural land and open space are converted into urban development, accompanied by a series of economic, social, and environmental problems” [41,45]This phenomenon was particularly prominent in the United States after World War II, when the country entered a prolonged period of metropolitan expansion and suburban growth. The “pastoral dream” has long represented the American cultural ideal of residential living. Suburbs were seen as symbols of privacy, safety, and independence—free from the high taxes and crime rates associated with urban life. These perceptions motivated a massive migration of the middle class to suburban areas.

At the same time, the large-scale construction of the national highway and road networks provided the necessary infrastructure for suburbanization. A series of federal “urban dispersal” policies, both intentional and incidental, strongly supported suburban development. Among the most impactful policies were those by the Federal Housing Administration (FHA), the Department of Veterans Affairs (VA), and the implementation of *The 1965 Interstate Highway Act*.[46]These initiatives made suburban housing more affordable than central city homes, accelerating the suburbanization process.



Figure2- 1 Aerial View of Levittown in the 1950s

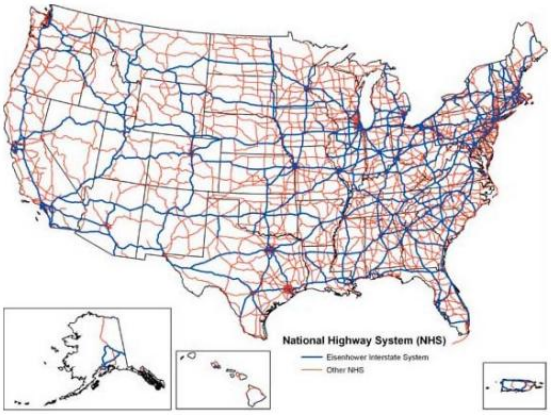


Figure2- 2 The U.S. National Highway System in 2000

(Source: http://en.wikipedia.org/wiki/National_Highway_System)

(2)Patterns and Morphologies of Urban Sprawl

DPZ summarized the spatial morphology of traditional development, second-generation suburban sprawl, and third-generation suburban sprawl. In fact, these correspond to the three major waves of suburban expansion in the United States since the Industrial Revolution.

Traditional Development Pattern (Late 19th Century to 1920s): Railroads and streetcars facilitated the migration of the middle class to suburban areas. Urban centers remained densely developed, while commercial and service facilities were distributed along primary rail lines.

Second-Generation Suburban Sprawl (1940s－1970s): Urbanization in the United States was characterized by the simultaneous development of metropolitan regions and suburbanization. This trend was particularly evident in the rapid growth of major metropolitan areas and the accelerated expansion of suburban rings within themAutomobiles and postwar federal policies drove extensive low-density suburban development.[47] The middle class relocated from urban centers to inner-ring suburbs. Large-scale commercial facilities were dispersed at major road nodes and intersections. Meanwhile, many central city neighborhoods began to experience urban decay, marked by depopulation, increasing poverty, and crime. Expensive suburban homes exacerbated spatial segregation among income groups.[48]

Third-Generation Suburban Sprawl (1980s－Present): The emergence of information technology and economic restructuring led to the rise of polycentric edge cities. As service-oriented and high-tech sectors increasingly became “footless industries,”[47] no

longer dependent on central locations, these enterprises preferred suburban sites with better environments and lower rents. This exacerbated urban hollowing and further extended sprawl into metropolitan hinterlands. Low-density single-family residential areas and cul-de-sac road patterns have led to fragmented suburban fabric.

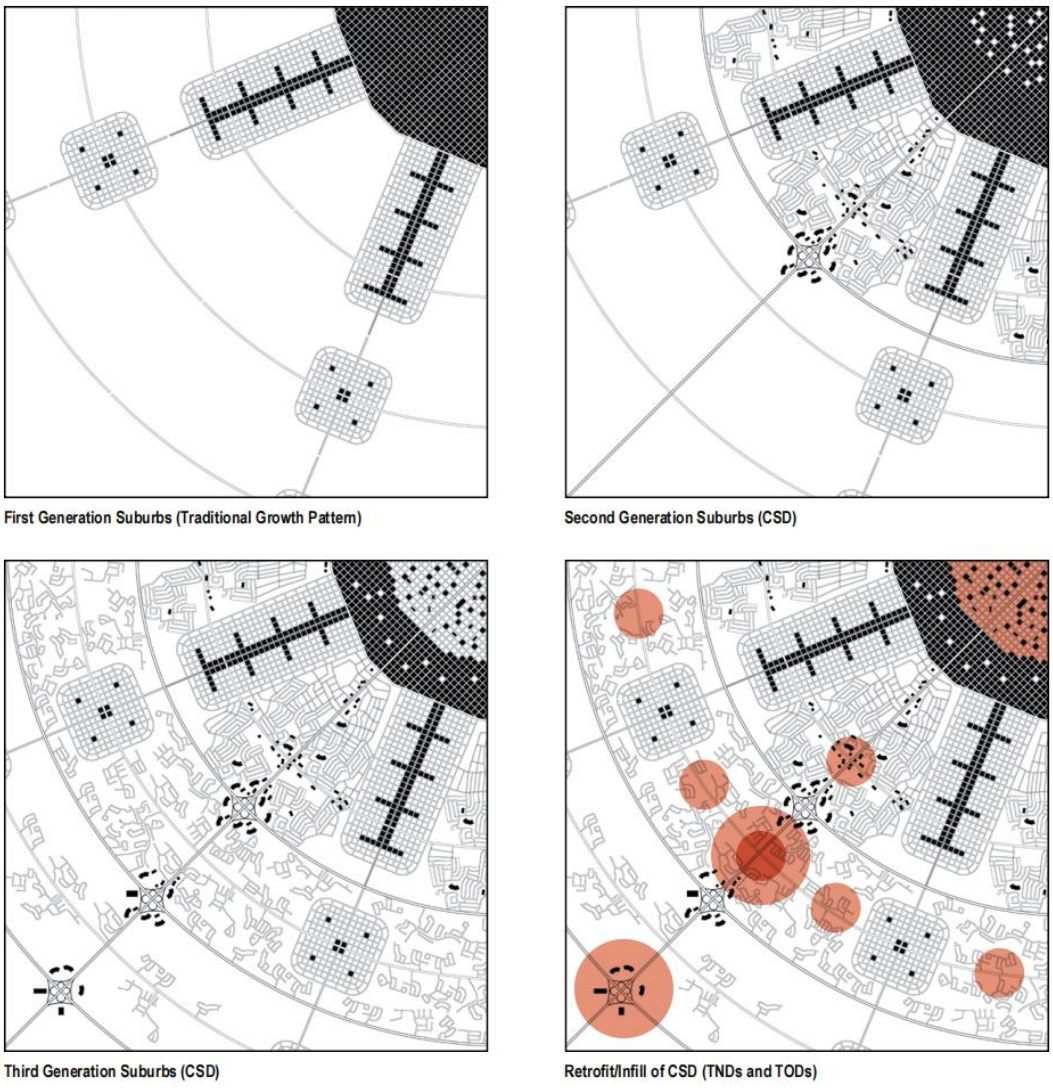


Figure2- 3Patterns of Urban Sprawl and TND/TOD Repair Models

(Source: DPZ. Suburban Retrofit – Infill and Sprawl Repair [EB/OL]. https://transect.org/research.html)

(3)Negative Impacts of Urban Sprawl

Urban sprawl has resulted in disordered low-density urban expansion. This disorder is manifested in land subdivision into fragmented single-family residential plots, winding cul-de-sacs, and commercial zones forming strip developments along arterial roads. Such low-density suburban growth has fostered community homogeneity—while middle- and high-income white populations migrated to suburbs, low-income groups and minorities

remained in central cities. The resulting inequality of resource access has aggravated social segregation and polarization. Urban hollowing in central areas has led to declining vitality and rising crime rates. Sprawl consumes vast areas of farmland, forests, and wetlands, contributing to land resource waste and environmental degradation. Functional separation and dispersed development have forced residents to rely heavily on automobiles for long commutes, leading to traffic congestion and air pollution.

(4)Drawbacks of Traditional Zoning

The early 20th-century American zoning system initially played a positive role in regulating land development and mitigating conflicts between different land uses. However, with urban evolution and societal transformation, the system's limitations became increasingly evident after the 1950s. Traditional use-based zoning inadvertently reinforced automobile dependency and ultimately fueled urban sprawl. Challenges such as spatial separation of jobs and housing, decline of walkability and public transport, and deterioration of urban centers and public spaces began to emerge [47]. Reflecting on zoning practices, scholars have highlighted excessive functional segregation, short-sighted planning, and passive regulatory approaches as major shortcomings.

Overly Strict Functional Separation: Traditional zoning practices typically involve three main zoning types: land-use zoning, height zoning, and bulk zoning. These practices strictly separate different land uses, aiming to minimize conflicts (especially between industrial and residential/commercial uses)and prevent overcrowding in city centers. While this separation reduced industrial disturbances in residential areas, it also fragmented urban functions, undermining spatial continuity and integrated development.

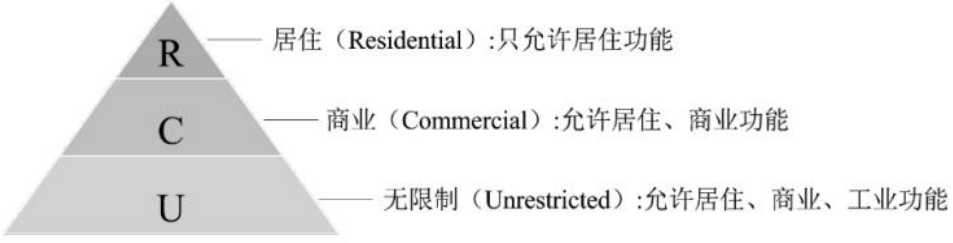


Figure2- 4 Three Types of Zoning in the 1916 New York Zoning Resolution
(Source: Reference[41])

Neglect of Long-Term Planning: This functionally segregated model treats land purely as a commodity, dividing it into different uses, while ignoring the fact that land is also a

component of the ecological system that requires protection and development [49]. As a result, zoning often focuses only on short-term interests, leading to uncoordinated urban sprawl and resource waste.

Passive Regulation: Traditional zoning is a relatively passive tool. It primarily regulates the volume of buildings through restrictions on building height, setbacks, and floor area ratios, thereby indirectly controlling building density and population concentration. However, it fails to actively guide high-quality urban design. It tells developers what not to do, but provides no guidance on what should be done.

Lack of Flexibility: Rigid rules restrict architects' creativity and the diversity of urban space. For example, regulations on building height and setbacks have led to "wedding cake" style buildings in many cities. While such standards, including building height limits and courtyard setbacks, may help prevent "canyon-like" street effects and ensure minimum ventilation and lighting, they often lack aesthetic or functional innovation.

(5)Attempts at Reform

As the drawbacks of traditional zoning became increasingly evident and urban space and social issues became more pressing, calls for reforming the conventional zoning system intensified. Since the 1960s, the United States introduced a series of zoning innovations, such as Performance Zoning, Incentive-based Zoning, Specific Zones, and Inclusionary Zoning. However, these approaches largely remained within the traditional zoning framework and failed to meet public expectations in terms of creating livable urban spaces and communities.

2.1.2 The Prototype of Form-Based Codes: A Dual Force of Theory and Practice

In terms of the evolution of form-based regulatory tools, the most representative development is the New Urbanism movement, which emerged after World War II and sought to reshape the built environment through the power of design. It advocated a comprehensive reassessment of existing zoning systems.[41] In the 1970s and 1980s, New Urbanists began to critically reflect on the phenomenon of urban sprawl and condemned the decentralized, fragmented construction advocated by modernism. Instead, they promoted compact urban forms as a means to achieve sustainable urban development.

(1) Spatial Principles of New Urbanism

New Urbanism is not a completely novel theory but rather an integrative planning and design approach that synthesizes earlier planning concepts. Its aim is to address the challenges of contemporary urbanization by redesigning cities and neighborhoods. The emergence of New Urbanism draws upon various precedents, including Howard’ s Garden City theory, the neighborhood unit concept, New Rationalism, and Jane Jacobs’ theories on urban diversity. It seeks to resolve contemporary urban challenges such as urban sprawl, traffic congestion, social segregation, and environmental degradation. At its core, New Urbanism promotes a return to traditional urban design principles in order to create more sustainable, livable, and human-scaled urban environments..

Its key principles can be summarized in three dimensions:

Transportation: Promotes walkability and public transit, creating pedestrian-friendly neighborhoods and reducing reliance on automobiles.

Land Use: Emphasizes functional mix, integrating residential, commercial, and office uses within neighborhoods and near transit stations to enhance land-use efficiency. Encourages social diversity by providing a range of housing types and prices to accommodate different income groups and household structures.

Spatial and Life Quality: Focuses on architectural aesthetics and functionality, emphasizes human scale, and aims to create attractive public spaces. Cultural facilities, public services, and vibrant community spaces are integral to improving quality of life.

(2)The Practical Prototype–*The Seaside Code*

Unlike traditional urban planning, which typically evolves from theory to practice, form-based codes emerged from practice before being formalized into theory. The modern prototype of FBCs originated from an experimental zoning ordinance created in 1982 by Andrés Duany and Elizabeth Plater-Zyberk for the town of Seaside, Florida (80 acres / approx. 32 hectares).[49] Known as the Seaside Code, this ordinance adopted a "second-order" rule system, combining textual descriptions and graphic illustrations to define design goals and visions for public spaces like streets and community areas. Private buildings were then regulated based on their relationship to public space, using a menu-style list of permissible building types.

In addition to serving as a design guide, *The Seaside Code* was legally enforced, regulating the development of all private buildings on the site and strongly shaping the town's future built environment.

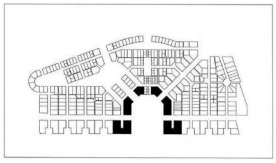
Seaside, located in Florida, covers about 80 acres (32 hectares)and was planned for a population of around 2,000—similar in scale to small American towns or neighborhood units from the 1920s–30s. In response to widespread suburban sprawl, DPZ sought new methods of design that could influence the larger urban form and foster a more coherent spatial experience. The town's isolated location made it an ideal testing ground. The DPZ team conducted field research on Southern towns, documenting elements such as clearly defined community centers, porches close to streets, and Caribbean-influenced vernacular architecture—arguing that these traditional spatial forms could offer valuable models for contemporary town design.

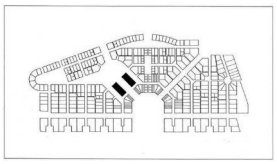
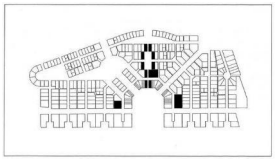
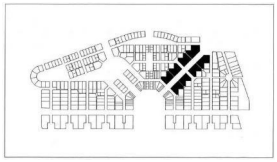
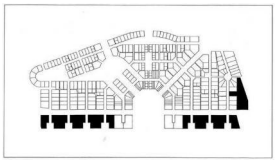
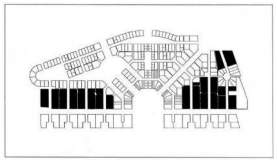
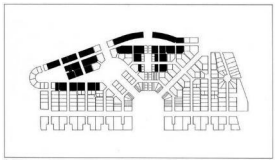
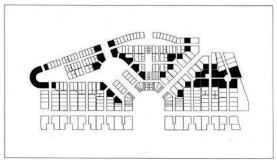
(3)Concept of Transect-Based Zoning

Initially, the DPZ team intended to design every building in Seaside to reproduce the aesthetic of Southern towns. However, they soon realized that such total control was neither feasible nor desirable. To harmonize building forms and preserve the town's character, they developed a set of prescriptive development controls that included: Overall zoning by building form and location, menu-style design codes that allowed participation from property owners and architects, while ensuring consistent urban character.

The approach emphasized planning over detailed design, guiding development through hierarchical zoning types—public spaces (streets, parks)first, private buildings second. A total of eight different form-based zones were created, each defined by its relationship to roads, landscape, and public spaces, along with specifications for permitted uses and building heights.

Table2- 1 List of Different Types of Building Zones in the Seaside Code
(Source: https://seaside.library.nd.edu/essays/the-code)

Zonging Type	Site Location	Streetscape Perspective	Description of Use and Form
Type I			**Use:** Ground floor retail, upper floors for residential use, hotel, or rental apartments. **Height:** 5 stories. **Form:** Buildings align with the street to form a

			continuous street frontage. No setback is required, creating a colonnaded or arcade-like pedestrian space.
Type II			These parcels define a small pedestrian plaza in front of the City Hall. **Use:** Primarily for office use, with allowances for apartments and retail spaces. **Height:** 4-story buildings with internal courtyards. Designed to create a more formal and dignified space compared to the central plaza.
Type III			**Use:** Large southern parcels are used as warehouses, while smaller plots are occupied by small shops. **Height:** 2 to 3 stories. Few restrictions; form is flexible.
Type IV			These large plots are located along the waterfront avenue, connecting the central plaza and the tennis club. **Use:** Private residences, small apartment buildings, or bed and breakfasts (B&Bs). Buildings should be set back on all sides, with porches on the street-facing side. A grand and formal architectural character is encouraged.
Type V		-	Strict control of building depth is discouraged, but lots should be grouped into continuous clusters.
Type VI			**Use:** Detached houses are encouraged, with optional rear accessory structures such as guesthouses or rental units. **Form:** Front yards should remain open to preserve sea views; fences should maintain a sense of spaciousness along the street.
Type VII			These parcels lack sea views and are thus more affordable. **Form:** No requirement for view corridors; front setbacks are minimal. Buildings on one side of the lot may align with the lot edge to allow for a private courtyard on the opposite side.
Type VIII			**Use:** Residential. **Form:** These zones act as gateways within residential neighborhoods. They allow greater design freedom to support architectural

			diversity, while preserving the residential character.

(2)Architectural Design Types

DPZ proposed a menu-based design guideline system. For the eight aforementioned building types, form-based constraints were set across five dimensions, requiring designers to create within a unified framework:

Building Placement: The “build-to line” regulates the building setback from the street, ensuring a continuous street interface.

Porches and Facades: Porches are mandatory, enhancing interaction between buildings and the street.

Accessory Structures and Parking: Designed to prevent parking from disrupting the street scale.

Building Height: Limited to maintain the character of a low-density community.

Mixed Uses: Each zone type includes compatible uses (e.g., residential, commercial)as prescribed.

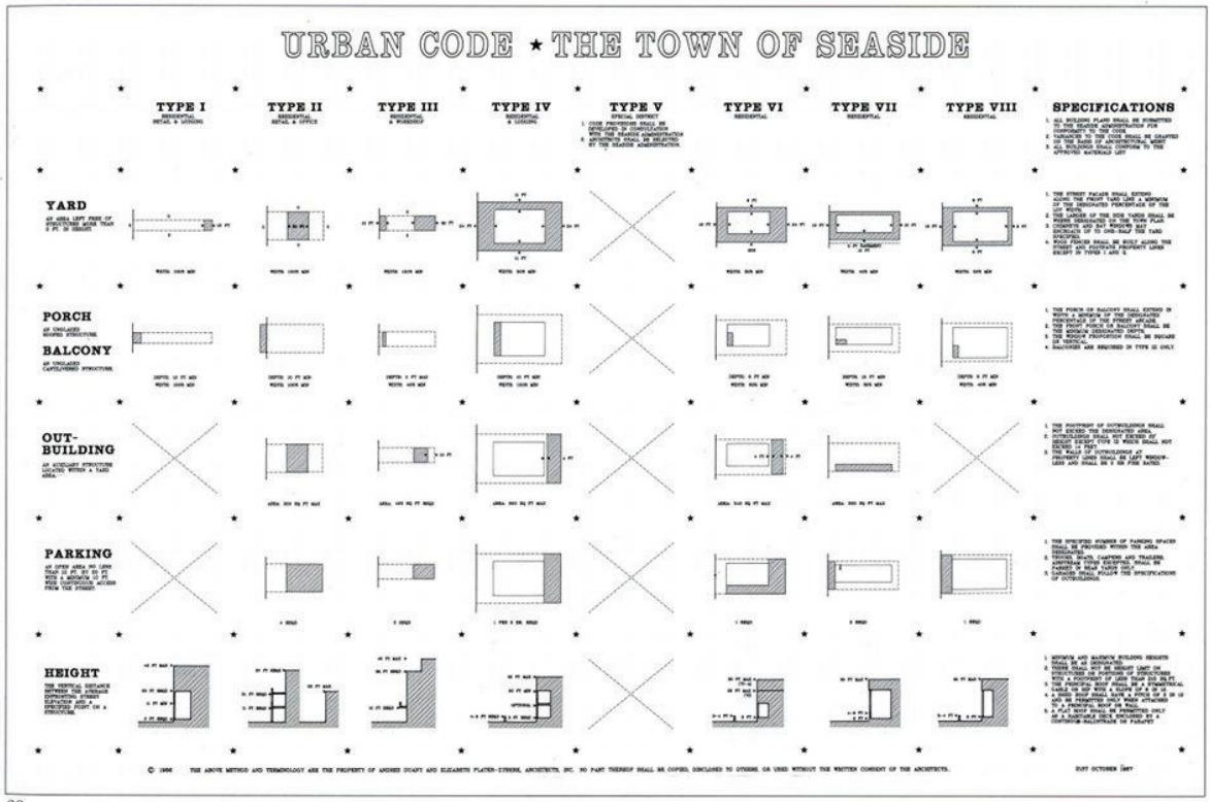


Figure2- 5 Menu-based Building Form List from the Seaside Code
(Source: https://seaside.library.nd.edu/essays/the-code)

As a landmark of New Urbanism theory, the Seaside community has frequently appeared in media and was named one of the best designs of the 1980s by *TIME* magazine. It also served as the filming location for *The Truman Show*, sparking public discussion about ideal communities. While maintaining comprehensive control, the Seaside Code preserved flexibility and openness in design, creating a harmonious townscape. It provided a design and implementation response to suburban sprawl and offered a "third option" beyond the binary of inner-city and suburb.

2.1.3 Theoretical Advancement of Form-Based Codes – Co-evolution with New Urbanism

The theoretical development of Form-Based Codes (FBCs)is closely tied to the advancement of the New Urbanism movement. In 1991, New Urbanists jointly launched the *Ahwahnee Principles*, which laid the foundation for the future practice of New Urbanism. Andres Duany and Elizabeth Plater-Zyberk, representatives of the East Coast movement, proposed the Traditional Neighborhood Development (TND)concept, representing community-level urban design thought. *The Traditional Neighborhood Development Ordinance* created by DPZ, Sam Poole, and Gary Greenan was adopted in Miami, Florida and later became a model for dozens of community developments.

In 1996, the publication of the *Charter of the New Urbanism* marked the maturity of the New Urbanism movement. It explicitly promoted illustrated codes as guidance for future development and challenged the traditional zoning ordinance.

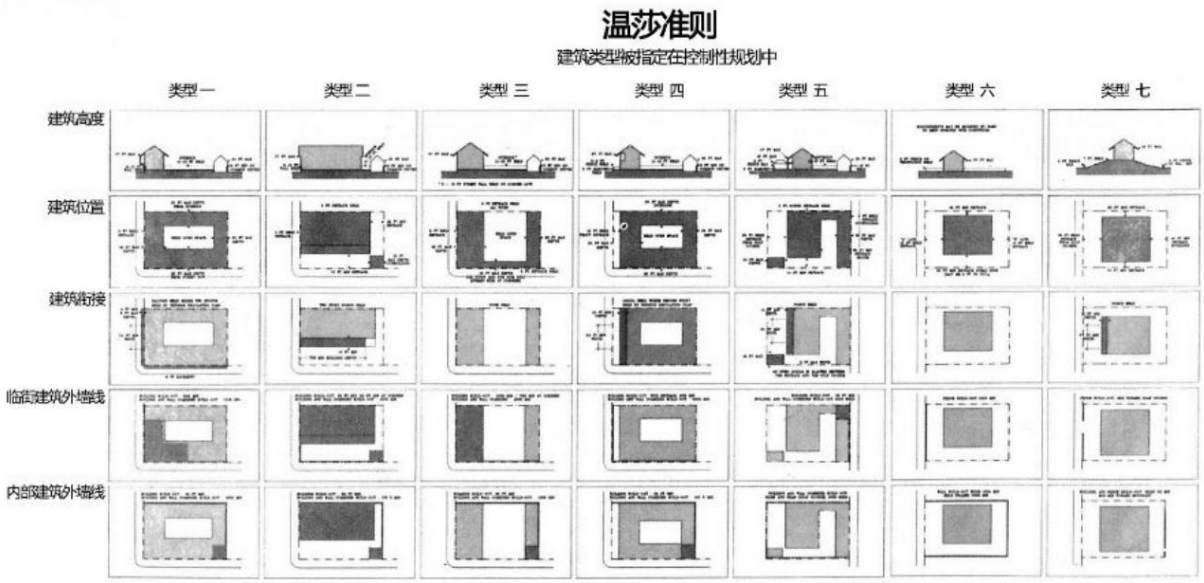


Figure2- 6 Excerpt from the Windsor Code
(Source: Reference[49])

Twenty years after the implementation of the Seaside Code, the term Form-Based Code was officially coined by Carol Wyant in 2001 and quickly gained traction. Around 1990, DPZ and other architects and landscape designers collaborated to develop Traditional Neighborhood Development Code/Ordinance (TND)for several towns and communities in Florida, guiding small-scale developments in places like Key West and the Village of Windsor(如图 2-6). With the momentum of New Urbanism, Form-Based Codes gradually became a vital tool in American urban planning. Planners began to explore FBCs as a new tool for regulating the built environment, addressing the shortcomings of traditional zoning.

2.1.4 Expansion of Form-Based Codes – Introduction of the Transect Concept

(1)Expanded Application of FBCs

Since the 1990s, the application of Form-Based Codes has expanded beyond greenfield developments to include infill in existing communities and downtown revitalization efforts. Their use, initially concentrated in Florida, gradually spread to other states.

(2)Introduction of the Transect Concept

Around 1994, Duany began working on the *Lexicon of the New Urbanism*. During its development, he realized the need for a theoretical system to express the internal relationships among terms and concepts. The transect concept was introduced to represent slices or gradients of human habitats across natural and built environments. It abstracted the human settlement environment into a continuum of zones—from rural to urban—emphasizing transitions between natural and built environments and across urban typologies.

In 2003, DPZ developed the first draft of the *SmartCode*, a comprehensive regulatory tool based on the transect model. That July, Petaluma, California became the first city to adopt a transect-based Form-Based Code.

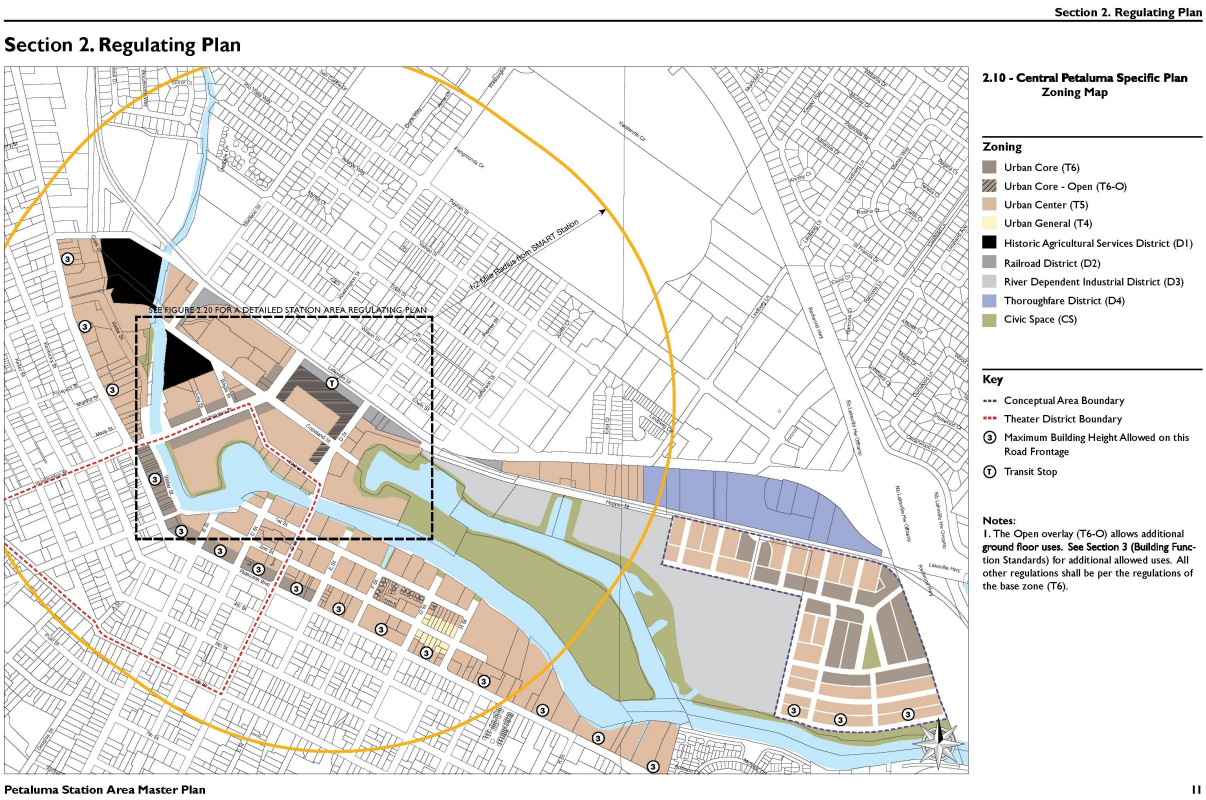


Figure2- 7 Petaluma Regulating Plan
(Source: https://petaluma.municipal.codes/SmartCode/2.10)

2.1.5 Standardization and Promotion of Form-Based Codes — Replacing Zoning Ordinances as a New Regulatory Framework

In 2001, Carol Wyant introduced the definition of "Form-Based Codes (FBCs)," which became the widely accepted and standardized term for this regulatory approach.

In 2004, Wyant, along with Peter Katz and others, co-founded the Form-Based Codes Institute (FBCI), a non-profit organization dedicated to the research and promotion of form-based codes.

From the early 21st century, Form-Based Codes entered a new phase of broader, more complex, and more diverse practical application. As of 2017, 88% of adopted form-based codes had been implemented after 2003 by local governments across the United States.

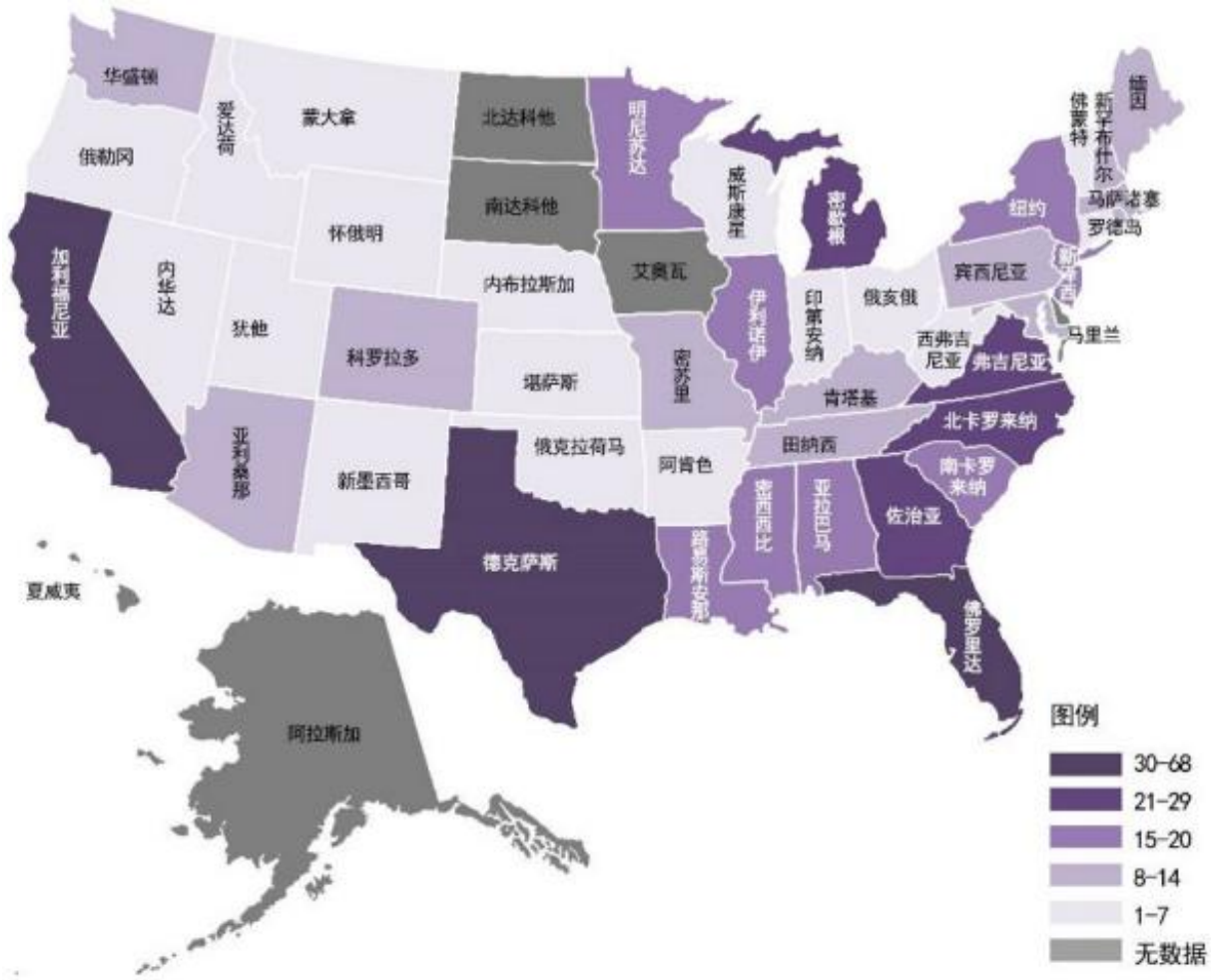


Figure2- 8 Number of Form-Based Codes Adopted by U.S. States (as of February 2017)
(Source: https://placemakers.com/codes-study/)

In 2005, Miami Mayor Manny Diaz decided to adopt a new zoning code—Miami 21—which integrated the principles of Smart Growth and New Urbanism. This marked the first instance of a major U.S. city replacing its conventional zoning ordinance with a form-based code. Since then, the adoption of Form-Based Codes has continued to spread. Major cities such as Denver, Cincinnati, and Nashville have also adopted similar regulations, making form-based planning a key tool in modern urban governance.

2.1.6 Summary

The development of Form-Based Codes has undergone four key phases: Emergence of prototypes - Theoretical refinement - Standardized definition - Widespread application (See Table 2-2).

Driven by the principles of New Urbanism and Transect Theory, Form-Based Codes have increasingly become essential tools for implementing Smart Growth and placemaking.

Their widespread application signals a shift in U.S. urban planning—from traditional function-based zoning to form-guided regulation.

Table2- 2 Key Stages and Milestones in the Development of Form-Based Codes
(Source: Compiled from References)

Key Stage	Year	Milestone Event
Emergence of Form-Based Codes	1981	The building codes applied in Seaside, Florida, are widely regarded as the prototype of form-based codes.
Since the 1990s, the scope of application expanded and spread to other states	1991	The Riviera Beach code in Florida was developed for a coastal city aiming to improve its economic foundation and urban landscape.
	1992	The city of Hayward, California adopted a new downtown plan based on form-based codes.
Introduction of the Transect Concept	**1994**	**Duany introduced the concept of the Transect while compiling the *Lexicon of the New Urbanism*.**
	1995	West Palm Beach, Florida also adopted a new downtown plan based on form-based codes.
	1995	Belmont, North Carolina became the first local government to offer form-based codes as an alternative to traditional zoning.
	1998	The Sonoma Development Code framed neighborhoods, districts, and corridors as planning units and integrated form-based codes into traditional zoning to create a hybrid code.
	1999	Dover, Kohl & Partners collaborated with DPZ to draft a 240-acre master plan and form-based code for Kendall, a new town in southern Miami.
Standardization of Form-Based Codes	**2001**	**Carol Wyant proposed the term "Form-Based Codes", which became widely accepted as the standard terminology.**
The first version of the *Smart Code* was introduced	**2003**	**DPZ developed the first draft of the *Smart Code* based on the transect, aiming to establish it as a formal regulatory planning tool.**
	2003	Columbia Pike in Arlington County, Virginia, used form-based codes to revitalize an aging commercial corridor.
The Form-Based Codes Institute (FBCI)was founded	**2004**	**Carol Wyant, along with Peter Katz and others, founded the nonprofit organization Form-Based Codes Institute (FBCI), dedicated to research and promotion of form-based codes.**
	2004	California became the first state to officially authorize form-based codes, revising its general plan guidelines to encourage local governments to adopt them in place of conventional zoning.
	2006	The TVC Code in St. Lucie County, Florida, consolidated development rights for a 28-square-mile agricultural area around Fort Pierce into several new towns and villages.
Form-Based Codes gradually replaced traditional zoning regulations as a new form of	2007	Miami adopted the *Miami 21 Code*, becoming the first major U.S. city to replace conventional zoning with a form-based code. Subsequently, cities such as Denver, Cincinnati, and Nashville

regulatory tool		also implemented form-based codes.

2.2 Main Contents of Form-Based Codes

2.2.1 Preliminary Understanding of Form-Based Codes

(1)Concept of Form-Based Codes

The Form-Based Codes Institute (FBCI)defines form-based codes as a type of land development regulation that fosters predictable built results and a high-quality public realm by using physical form (rather than separation of uses)as the organizing principle. Form-based codes are regulations, not mere design guidelines.[50] They can be legally integrated into the ordinances of cities, towns, or counties, offering a powerful alternative to conventional zoning.[41]。

(2)Form Control vs. Index Control

Form-Based Codes divide control zones based on spatial elements characterized by physical form, thereby governing specific regulatory content (as shown in Figure 2-9)and directly controlling the spatial morphology of sites. In contrast, traditional zoning primarily regulates the nature and intensity of land use, focusing on function-oriented control. It typically uses abstract metrics such as density, floor area ratio (FAR), and maximum building height to control development parameters, with complex provisions specifying prohibited uses. In other words, without control over building massing, restrictions on intensity and density often lead developers to deliberately avoid these limits, resulting in “matchbox”-style buildings (left diagram in figure2-9). Although planners attempt to address this through urban design, efforts often fall into the cliché of merely shaping the external landscape of lots (middle diagram in figure2-9).[17]

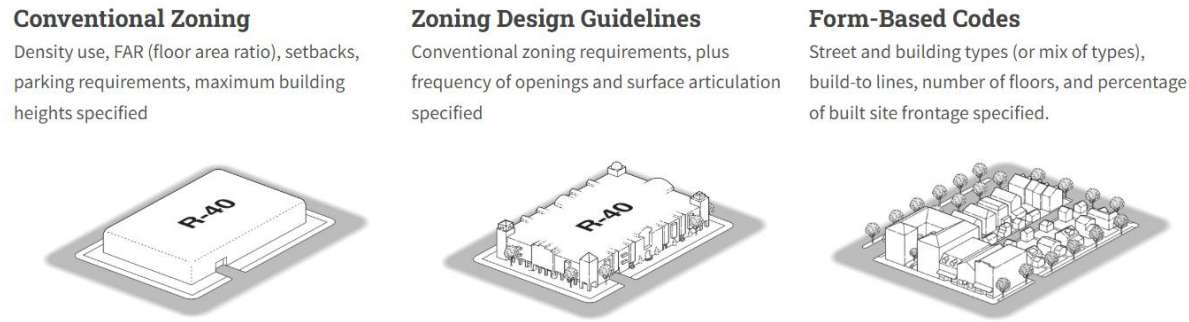


Figure2- 9 Comparison Diagram of Spatial Effects of Traditional Zoning, Urban Design Guidelines, and Form-Based Codes
(Source: https://formbasedcodes.org/)

(3)Form Control Precedes Functional Regulation

The core difference between form-based codes and traditional zoning lies in the priority of form control over use regulation.[39] Form-based codes are development rules founded on a vision that requires all developments to participate in creating places that reflect the community’s shared expectations. Therefore, at the outset of drafting these codes, a detailed vision must be crafted and then enforced through the formulation and management of the form-based codes. This vision is built upon and reinforces the characteristics of the community and locality, making it customizable to establish a unique vision for each place.[17]

In traditional zoning ordinances, the main difference between zones lies in the permitted land uses, and all regulatory content is based on these segregated use districts. Urban form control tools focus on regulating the built environment at the micro-level, such as building form, building layout, and civic activity spaces, representing a parcel-level, form-oriented control (see Figure 2-9, right). Form-based codes clarify the form of parcels through legal and regulatory means, using graphical and textual methods. It can be said that the development trajectory of urban form control tools reflects a shift in American urban planning toward material spatial design or spatial form, aiming to reform urban functions and spatial experience.[17]

Table2- 3 Summary of Differences Between Traditional Zoning and Form-Based Codes
(Source: Compiled from Various References)

Type	Traditional Zoning	Form-Based Codes (FBC)
Legal Effectiveness	Statutory regulation, mandatory enforcement	Statutory regulation, mandatory enforcement
Control Focus	Abstract indicators such as land use, floor area ratio, height limits	Quantitative and qualitative control of building form, street frontage, and public space
Output Format	Mainly text, supplemented by 2D land-use maps	Illustrated regulatory documents combining text and images, including 3D form diagrams
Implementation Outcome	Prone to producing “matchbox” buildings (see Figure 2-9 left)	Directly shapes human-friendly spaces (see Figure 2-9 right)

2.2.2 Organizing Principles of Form-Based Codes

As a form-driven planning tool, the core principles of form-based codes aim to shape high-quality urban environments by controlling physical form. These principles include:

(1)Emphasis on Spatial Form

Form-based codes shift away from function-led zoning to control areas based on spatial form. Through regulating plans, different zones are defined by their boundaries and spatial elements such as corridors and public spaces.

(2)Flexible Organizing Principles

The organizing principle of form-based codes (FBC)is the inherent logic behind their regulatory content. Depending on the scale and needs of a project, form-based codes can adopt different organizing principles, such as the rural-to-urban transect, building type standards, or street frontage types. For example, if the primary goal of a project is to create engaging street spaces, most regulations will focus on building façade appearances and necessary street spatial forms. In this case, different types and functions of street frontages can serve as the organizing principle, dividing the area into various regulatory zones that guide specific changes in building and landscape parameters. These organizing principles offer flexibility to address diverse design objectives, such as creating vibrant streetscapes, preserving historic character, or promoting community diversity (see Figures 2-10). It should be noted that the SmartCode, which is a transect-based code form, is not synonymous with the core content of form-based codes. The SmartCode can be understood as a toolkit of form-based regulations, allowing different projects to select different components, so its outcomes are not fixed or uniform.

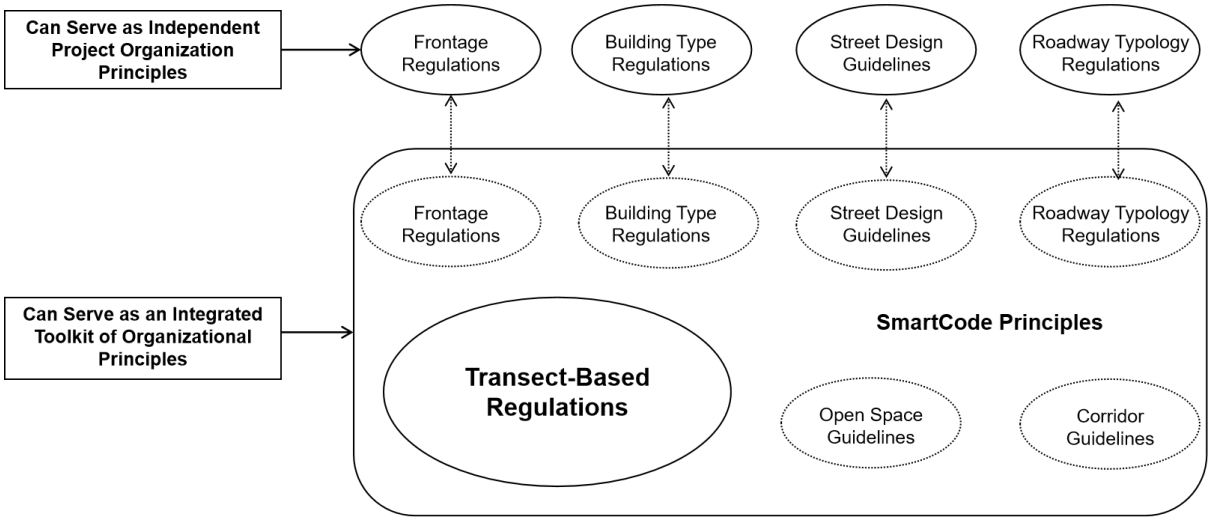


Figure2- 10 Illustration of the Organizing Principles of Form-Based Codes
(Source: Drawn by author)

(3)Multi-Stakeholder Participation and Local Character Identification

The formulation of form-based codes emphasizes broad participation from multiple stakeholders, including community residents, government authorities, and developers. Through vision planning, the future form types of the area are clearly defined. The outcomes of this process include not only the regulating plan but also illustrative plans and vision diagrams, which transform design intentions into actionable and enforceable regulatory standards (see Figures 2-11).

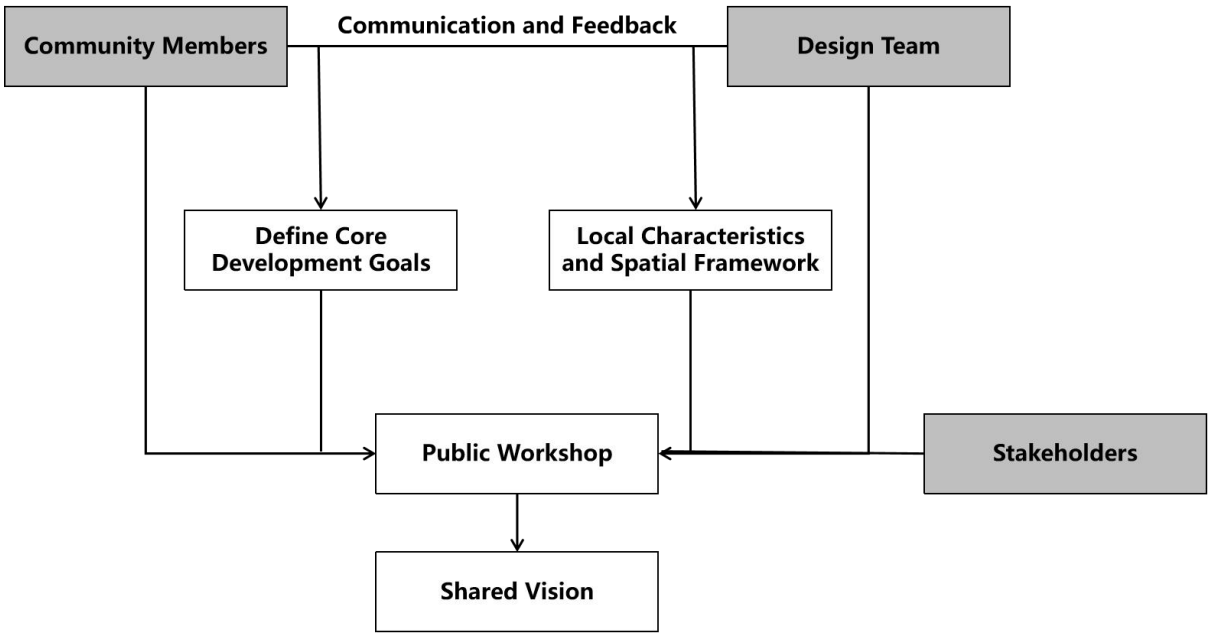


Figure2- 11 Standard Formulation Process of Form-Based Codes
(Source: Reference[38])

(4)Priority on Public Space

Form-based codes place special emphasis on the design of public spaces, particularly the shaping of thoroughfares and civic spaces. Through pedestrian-oriented design controls, form-based codes ensure that public spaces are accessible, comfortable, and safe (see Figures 2-12 and 2-21).

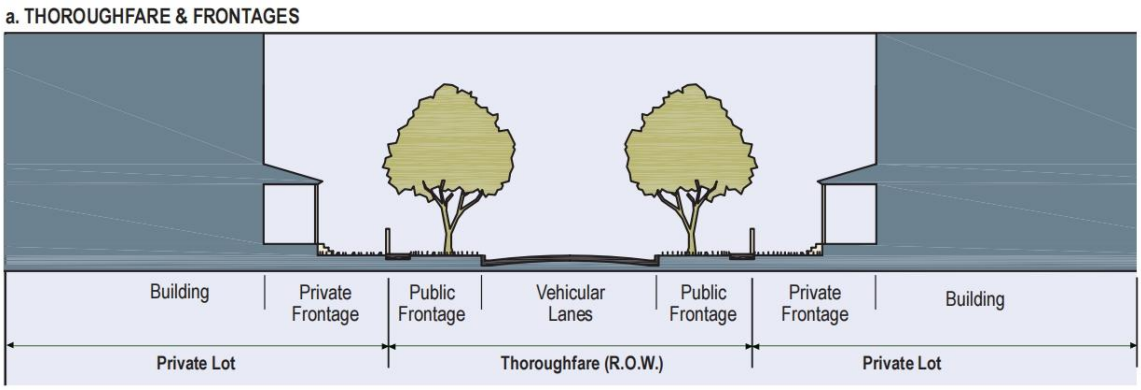


Figure2- 12 Illustration of Thoroughfare and Frontage Standards
(Source: Reference[20])

2.2.3 Core Components of Form-Based Codes

Form-based codes are primarily composed of three key parts: Regulating Plan, Building Standards, and Public Space Standards.

(1)Regulating Plan

A regulatory site plan or map that designates areas where different building form standards apply.

The regulating plan is the core component of a form-based code. Its primary function is to define form-based zones and regulatory requirements through a graphic format. The regulating plan diagram consolidates parcel boundaries, street networks, and public spaces, representing the comprehensive vision and control logic of the form-based code.

Based on the rural-to-urban transect or other organizing principles, the regulating plan further regulates physical elements in the built environment—such as buildings, parcels, land uses, and streets — by dividing the area into distinct form-based zones. It also clearly delineates the boundaries and spatial characteristics of each zone. These zones are supported by narrative descriptions that clarify the intended overall character, landscape features, and architectural forms. For example, in the Santa Ana Renaissance Specific Plan, the Downtown Zone is described as follows: “This area represents the historic and current heart of Santa Ana. It is defined by multi-story urban building types such as commercial blocks, live-work units, stacked flats, and courtyard housing at the edges of downtown. It accommodates a mix of retail, office, light service, and residential uses. The standards are intended to reinforce the forms and characteristics typical of pre-WWII development through infill and restoration. This is a key pedestrian-oriented area.” These descriptions emphasize the importance of historic character preservation in the Downtown (DT)Zone, while also highlighting a mixed-use functional layout, shaded street views with tree canopies, and the principle that parking facilities should remain hidden from sight.

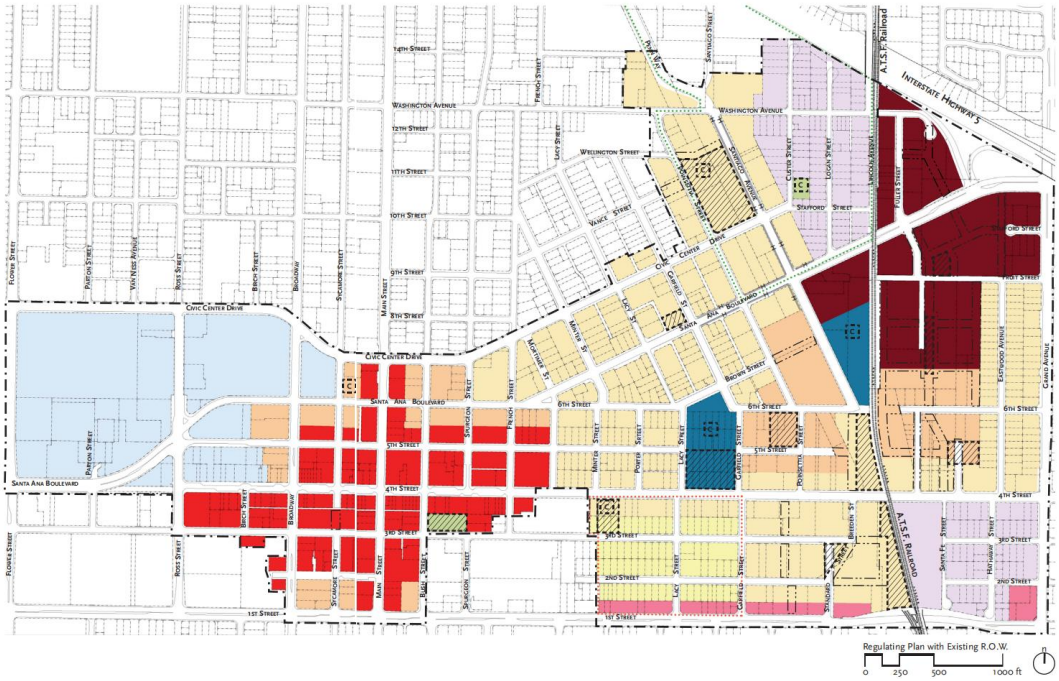


Figure2- 13 Regulatory Plan of Santa Ana
(Source: Santa Ana Renaissance Specific Plan)

- **Functional Regulation Standards:** Form-based codes emphasize functional diversity—some focus on mixing various functions within a district, while others stress vertical integration of different uses within a building. Functional regulation standards flexibly guide land use by listing permitted building use types, restricting certain land uses to specific zones, and setting review requirements for land use applications (as shown in the figure2-14).

Table 2A - Use Standards

Land Use Type	Permit Required by Zone					
	TV	DT	UC	CDR	UN-2	UN-1
Refer to Key to Zone Symbols table on following page for zone description and use notations						
RESIDENTIAL						
Live-Work Use / Joint living-working quarters	P (2)	P (2)	P (2)	P (2)	CUP	CUP
Care Homes	CUP	CUP	CUP	CUP	CUP	CUP
Single Dwelling	---	---	---	---	P	P
Multi-Family Dwellings	P (1)	P (1)	P (1)	P (1)	P	P
RECREATION, EDUCATION AND ASSEMBLY						
Community assembly	P(1)	P (1)	P (1)	P	CUP	CUP
Health/fitness facility	P	P	P	P	CUP	---
Library, museum	P	P	P	P	P	CUP
Schools	P (1)	P (1)	P (1)	P	CUP	CUP
Studio	P	P	P	P	CUP	CUP
Theater, cinema or performing arts	P	P	P	P	---	---
Commercial Recreation (Indoor)	CUP	CUP	CUP	---	---	---
RETAIL						
General retail, except with any of the following features	P	P	P	P	P(2)	---
• Floor area over 20,000 per tenant	CUP	CUP	P	---	CUP	---
Eating establishments	P	P	P	P	P(2)	---
Auto or motor vehicle service	---	---	P	P	---	---
SERVICE GENERAL						
Banquet facility/catering-sub. to 41.199.1(a) through (d)	CUP	CUP	CUP	CUP(1)	---	---
Child day care - more than 8 and up to 14 children	P (3)	P (3)	P	P	LUC(2)	LUC
Child day care center	P (3)	P (3)	P	P	CUP	CUP
Adult day care center-subject to 41.199.2 of the SAMC	P (3)	P (3)	P	P	P	---
Hotel, excl. transient residential hotel and long term stay	P	P	P	P	---	---
Mortuaries, funeral homes	---	---	CUP	P	---	---
Personal services	P	P	P	P	P(2)	P (2)
Personal services - restricted	---	---	CUP	CUP	CUP	---

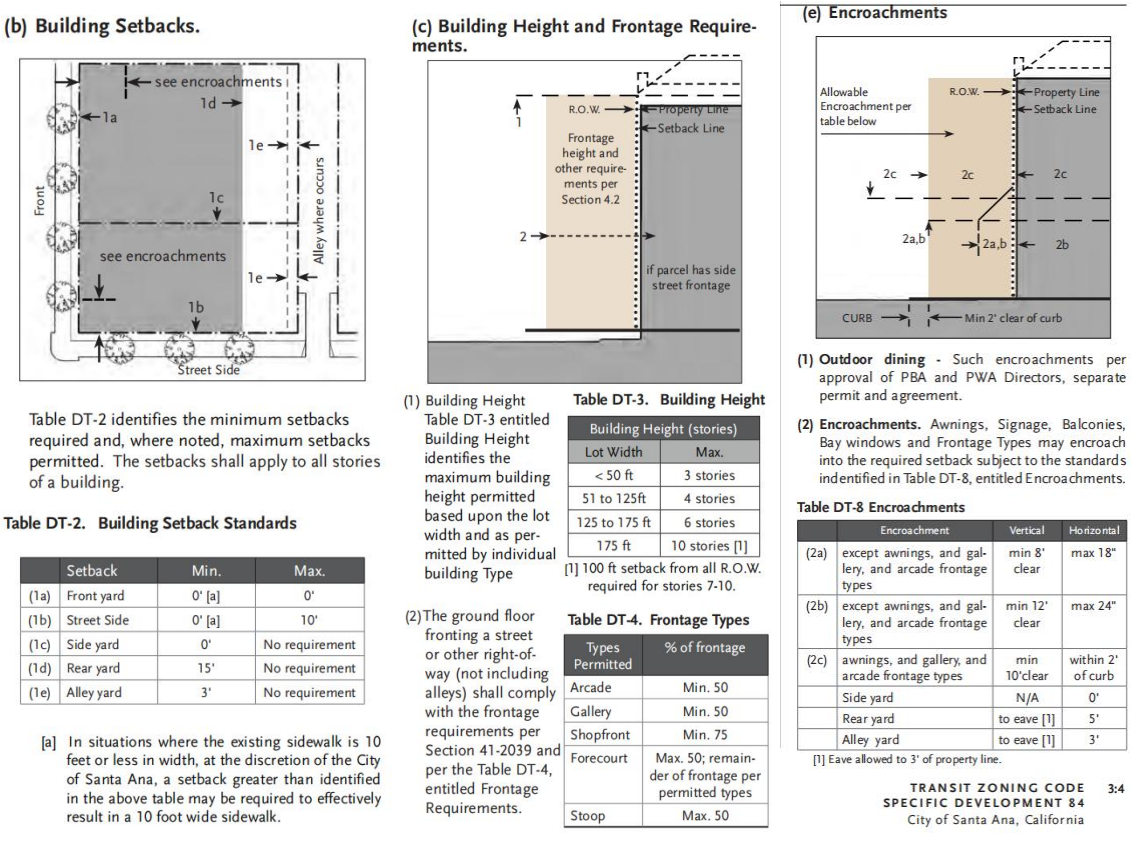
Figure2- 14 Functional Regulation Table of Santa Ana
(Source: Santa Ana Renaissance Specific Plan)

(2)Building Standards

Building standards include multidimensional regulatory requirements such as building layout and building type codes, aiming to control building forms through a variety of parameters.

- **Building Layout Requirements:**

These are regulations that define and shape the characteristics, configuration, and functions of buildings in relation to the public realm. Based on the delineation of form-based districts, specific layout requirements are proposed for each district (taking the DT District as an example): The position and size of buildings are regulated through Build-to Lines (BTL)and Setback Lines, which may allow building components to encroach into street space. This ensures the quality of public spaces while maintaining a flexible relationship between private structures and the public streetscape (see Figure 2-15).



(b) Building Setbacks.

Table DT-2 identifies the minimum setbacks required and, where noted, maximum setbacks permitted. The setbacks shall apply to all stories of a building.

Table DT-2. Building Setback Standards

	Setback	Min.	Max.
(1a)	Front yard	0' [a]	0'
(1b)	Street Side	0' [a]	10'
(1c)	Side yard	0'	No requirement
(1d)	Rear yard	15'	No requirement
(1e)	Alley yard	3'	No requirement

[a] In situations where the existing sidewalk is 10 feet or less in width, at the discretion of the City of Santa Ana, a setback greater than identified in the above table may be required to effectively result in a 10 foot wide sidewalk.

(c) Building Height and Frontage Requirements.

(1) Building Height Table DT-3 entitled Building Height identifies the maximum building height permitted based upon the lot width and as permitted by individual building Type

Table DT-3. Building Height

Building Height (stories)	
Lot Width	Max.
< 50 ft	3 stories
51 to 125ft	4 stories
125 to 175 ft	6 stories
175 ft	10 stories [1]

[1] 100 ft setback from all R.O.W. required for stories 7-10.

(2) The ground floor fronting a street or other right-of-way (not including alleys) shall comply with the frontage requirements per Section 41-2039 and per the Table DT-4, entitled Frontage Requirements.

Table DT-4. Frontage Types

Types Permitted	% of frontage
Arcade	Min. 50
Gallery	Min. 50
Shopfront	Min. 75
Forecourt	Max. 50; remainder of frontage per permitted types
Stoop	Max. 50

(e) Encroachments

(1) **Outdoor dining** - Such encroachments per approval of PBA and PWA Directors, separate permit and agreement.

(2) **Encroachments.** Awnings, Signage, Balconies, Bay windows and Frontage Types may encroach into the required setback subject to the standards indentified in Table DT-8, entitled Encroachments.

Table DT-8 Encroachments

	Encroachment	Vertical	Horizontal
(2a)	except awnings, and gallery, and arcade frontage types	min 8' clear	max 18"
(2b)	except awnings, and gallery, and arcade frontage types	min 12' clear	max 24"
(2c)	awnings, and gallery, and arcade frontage types	min 10'clear	within 2' of curb
	Side yard	N/A	0'
	Rear yard	to eave [1]	5'
	Alley yard	to eave [1]	3'

[1] Eave allowed to 3' of property line.

TRANSIT ZONING CODE 3:4
SPECIFIC DEVELOPMENT 84
City of Santa Ana, California

Figure2- 15 Building Layout Standards of Santa Ana
(Source: Santa Ana Renaissance Specific Plan)

- **Building Type Standards (Building Types):**

The building type standards are derived from locally existing, regionally distinctive building forms. Within each designated district, they specify the allowable types of buildings —such as single-family houses, townhouses, apartment buildings, etc.—to reinforce local

character. These standards classify buildings into 13 types based on criteria such as building scale, massing, density, number of units, arrangement patterns, and courtyard relationships. They set out detailed regulations for aspects including building density, dimensions, maximum number of stories, frontage types, permitted building types within transect zones, courtyard sizes, parking space requirements, and more. The aim is to ensure that new private developments remain consistent with the established urban form and local identity of the built environment.

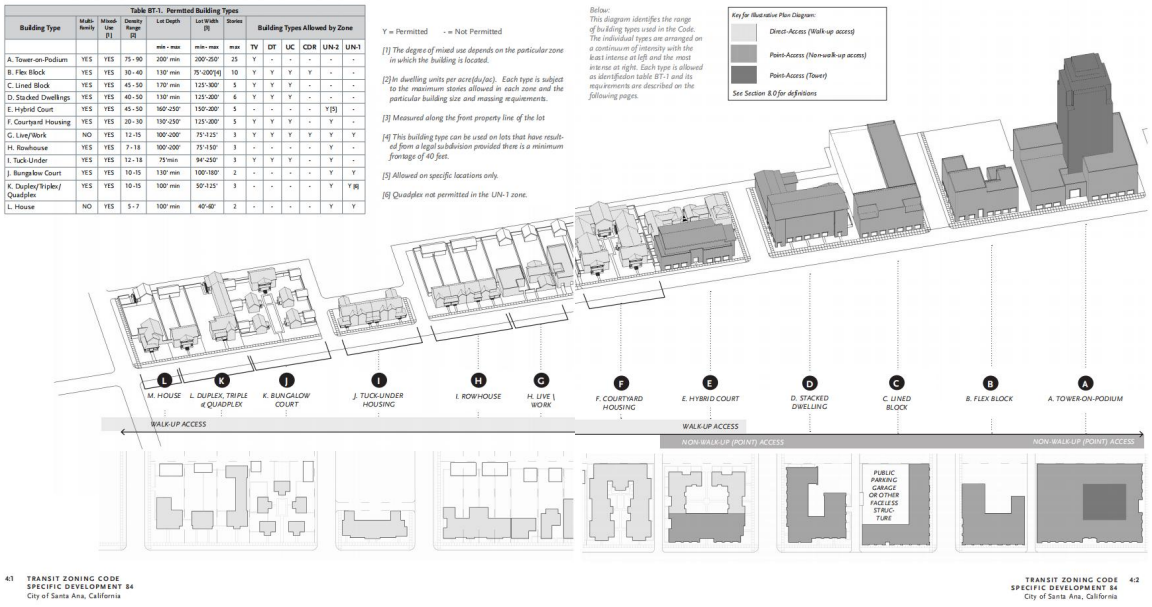


Figure2- 16 Building Type Standards of Santa Ana
(Source: Santa Ana Renaissance Specific Plan)

For different building types, specific regulations are provided regarding form, massing, height, width, and other physical attributes, to ensure a harmonious proportion between buildings and public spaces (as illustrated in the figure2-16).

(2)Public standards

These standards designate elements within the public realm, such as sidewalks, travel lanes, on-street parking spaces, street trees, and street furniture.

- Frontage Standards: Frontage standards regulate the relationship between buildings and the street, including requirements for building setbacks, façade design, entrance configuration, and more.

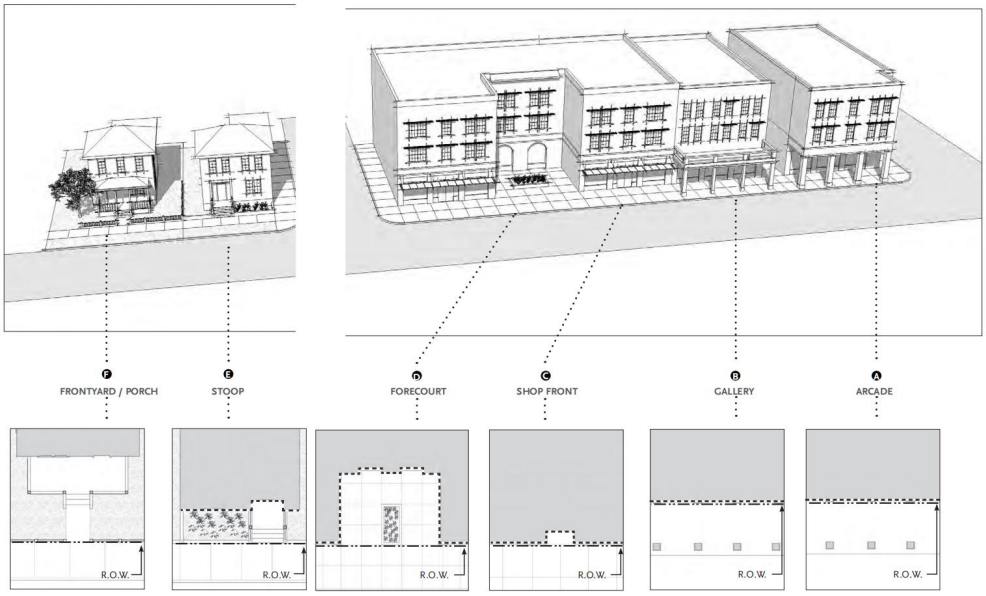


Figure2- 17 Frontage Type Standards of Santa Ana
(Source: Santa Ana Renaissance Specific Plan)

- Street and Streetscape Standards: These standards specify the design criteria for streets, including lane widths, sidewalk dimensions, landscaping, and more. Detailed regulations and guidance are provided regarding the orientation of traffic, parking layouts, building setbacks, and the placement of tree lawns along different types of urban streets.

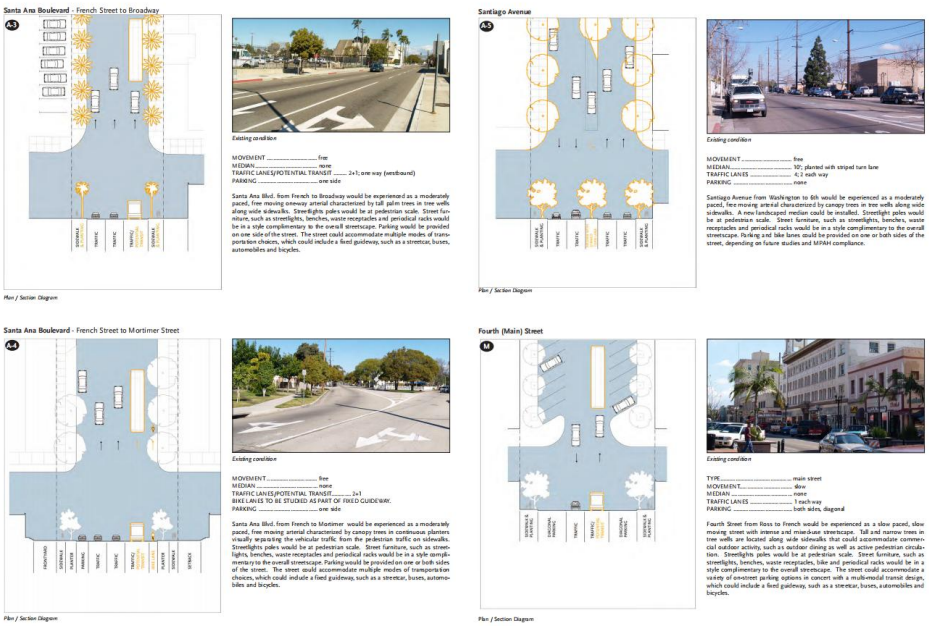


Figure2- 18 Santa Ana City Planning Frontage Type Standards
(Source: Santa Ana Renaissance Specific Plan)

(3)Other Optional Standards

Form-Based Codes can also flexibly incorporate additional regulatory content based on

local needs, such as open space standards, block standards, green building standards, landscape standards, historic building preservation standards, and more. Together, these standards form a detailed and customizable system capable of addressing the specific requirements of different communities.

(4)Summary

Form-Based Codes, through regulating plans and form control standards, focus on spatial form characteristics and adapt flexibly to the planning needs of various regions. Their organizing principles are diverse, allowing different control elements to be selected according to project requirements. By integrating public space standards and building form standards, they enable precise control over urban form. Form-Based Codes are not merely static regulatory tools but dynamic action plans that emphasize multi-stakeholder participation and local character identification, providing a flexible and practical framework for urban design.

2.3 Core Ideas of Form-Based Codes

2.3.1 Theoretical Foundation Rooted in Typology

(1)Return to the Typological Thought of Traditional Towns

The birth of New Urbanism coincided with a period of reflection on modernist architecture. Among various critical perspectives, typology emphasizes tradition rather than blindly pursuing innovation. Typology seeks to explore the unchanging essence within buildings and the relationship between changing external architectural forms and this essence. Representative scholars include the renowned Italian Muratori School, Aldo Rossi (1984), the Krier brothers (Leon Krier 1979, Rob Krier 1979), Vidler (1978), Moneo (Bandini 1984), and Moudon (1994). Although their understandings and applications of typology differ, they all agree that typology expresses urban culture and collective memory and can be perpetuated through temporal evolution. This is not only a spontaneous urban phenomenon but also an urban architectural language usable in design.[51]

Among them, the Krier brothers particularly advocate for classical architectural and urban types, mostly reflected in large-scale designs such as urban public spaces. Leon Krier lectured in the United States in the 1970s, where his teachings on European **Classicism** architectural and Neorationalism ideas deeply attracted architects Andrews Duany and

Elizabeth Plater-Zyberk, who were studying at Yale at the time. They often explored the traditional buildings of New Haven County during their free time.

Leon Krier promoted a return to classical architectural and urban types. He analyzed traditional European towns and believed that a city is composed of three elements: urban blocks, streets, and squares[52]. In his view, traditional European towns have a clear hierarchical structure, distinct centers, and a rational spatial organization. Returning to the layout of traditional towns can restore urban order. Krier divided urban form elements into two categories: public and private. Public buildings include churches and public spaces, while private buildings include residences and shops. He argued that public buildings have rich forms and dominate the city, whereas private buildings should serve as the backdrop subordinate to public buildings, as illustrated in Figure 2-19. Krier's thoughts on urban space typology deeply influenced the Duany couple. From 1981 to 1982, the Duanys invited Krier to participate and serve as the theoretical advisor for the design of a waterfront town community.[53]



Figure2- 19 Leon Krier's Architectural Typology
(Source: Reference[52])

(2)Application of Typological Thought in the Waterfront Town

Form-Based Codes (FBC)essentially belong to typology. They require extensive study of the various building and public space forms in the local city, seeking relatively fixed elements that compose a place. This is a process of classification and abstraction, from which derived types can be associated with regional characteristics. Form-Based Codes inherit the type-based design approach, aiming to establish an ordered yet diverse urban fabric by organizing building and urban space types. Since the practice of the Waterfront Town, this typological thinking has been rooted in the technical methods and intrinsic logic of Form-Based Codes. At the outset of the design, the Duany couple conducted thorough research on traditional towns in the southern United States, hoping to build a highly recognizable and impressive community that embodies the characteristics of southern

traditional towns. Therefore, they established the basic elements of the waterfront community: a grid street network, a certain amount of public space (parks, squares, etc.), a clear community center, and porches facing the street.Through the creation of public spaces, the overall spatial pattern of the waterfront town was established: a grid-like road network covers the entire town; memorial-style buildings are arranged along the town center axis, creating a strong sense of place in the public realm; the streets are relatively narrow, focusing on creating a pedestrian-friendly atmosphere, with cars passing slowly on the side, accessing garages at the rear of residences via narrow alleys.[46]

Based on this public space structure, the urban fabric is completed by infill development. Qualitative requirements regarding building height, porches, and courtyards are proposed for private buildings in different zones. This planning sequence of prioritizing public spaces followed by private residential areas was eventually formalized in text form as part of the Charter of the New Urbanism, establishing it as a planning guideline for New Urbanist communities.[53]

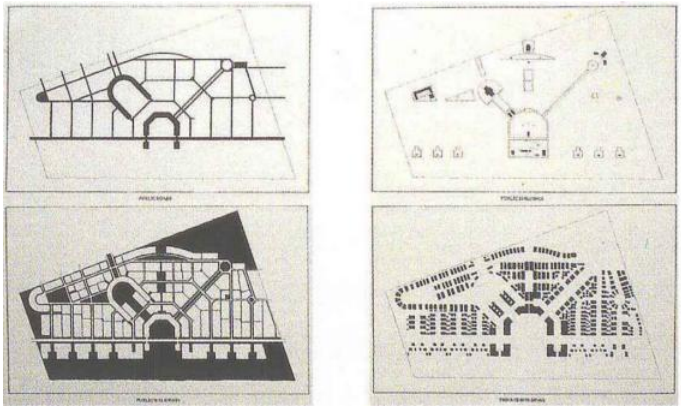


Figure2- 20 Hierarchical Spatial Elements of the Waterfront Town

(Source: Reference)

(3)Establishing a Multi-Scale Typological Control System

The preparation of Form-Based Codes first requires a thorough understanding of local characteristics through comprehensive research on the various physical form elements in the area. This involves analyzing and extracting recurring elements, from which abstracted form types can be linked to regional features.[41]

Based on the concept of cross-sections, Form-Based Codes establish a multi-level, full-scale spatial architectural form requirement system, ranging from rural transects to urban

cores (T1 – T6), covering all scale levels from region to building. Each level should reflect the local history, culture, and regional characteristics. Quantitative regulatory requirements are set for each zone regarding building setbacks, building heights, courtyards, parking, etc., supplemented by qualitative textual descriptions. For example, the Cincinnati Code, through comprehensive research of local buildings, collects and organizes recurring spatial elements and extracts, classifies, and summarizes comprehensive form elements such as lot scale, building form, setbacks, and building heights. This results in multiple transect-based zoning categories (see Figure 2-21). Typological logic runs throughout this integration process. By using quantitative form dimensions combined with qualitative descriptions, these concrete types form a new indicator system. This system serves as the basis for development regulations authorization, differing from the traditional zoning logic based on land use and abstract indicators.[41]

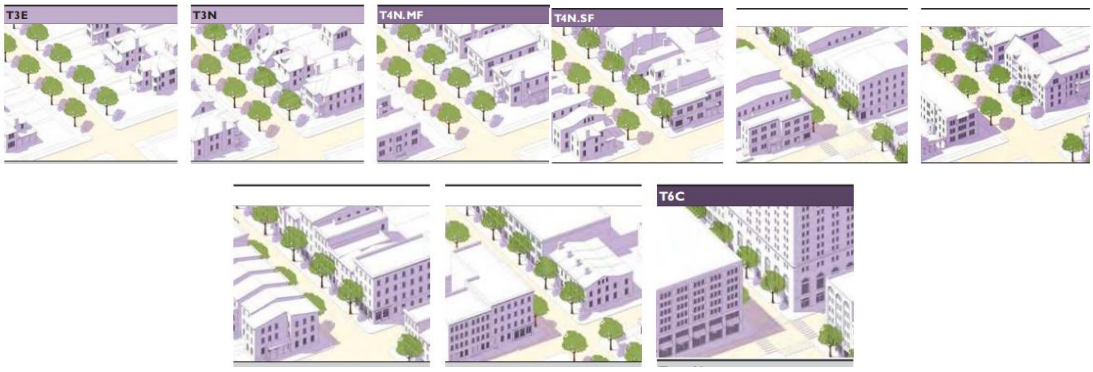


Figure2- 21 Illustration of Cincinnati Transect Zones
(Source: Cincinnati Form-Based Code)

2.3.2 Three-Level Spatial Scale Framework: Region, Neighborhood, Street

(1)The Three-Level Scale Framework of New Urbanism

In the 1970s and 1980s, New Urbanists began integrating multiple urban theoretical ideas such as the Garden City movement, City Beautiful movement, and neighborhood units. Although they did not create a completely new theoretical system, New Urbanism gradually formed a set of design principles and theoretical guidelines. As a concept of physical spatial design, New Urbanism provided the theoretical foundation for SmartCode and Form-Based Codes, and offered an action framework for both [17]. In response to issues such as urban sprawl and social segregation, New Urbanists strongly advocated clearly defined rural-urban boundaries and proposed prioritized infill development at the region, neighborhood, and

street scales. They emphasized coordinating the relationships between regional centers, cities, and their surrounding areas, while creating and preserving valuable urban places.

The 1996 publication of *The Charter of the New Urbanism* established the theoretical and practical guidelines of New Urbanism and clearly defined a three-level spatial framework — from regions, metropolitan areas, and towns, to neighborhoods, districts, and corridors, down to blocks, streets, and buildings (see Table 2-4). This framework reflects a clearer and more systematic theory and set of proposals by New Urbanists[41]. At the regional level, *the Charter* encourages infill development, emphasizes development connected by public transit networks, and advocates clearly defined natural geographic boundaries to preserve the spatial distinction between urban and rural areas, thereby curbing uncontrolled urban sprawl. At the neighborhood level, it promotes compact mixed-use development as a replacement for separated land-use patterns, encourages transit and walking, and uses open spaces to define neighborhood boundaries. At the building level, it focuses on shaping diverse types of streets and public spaces to create safe and comfortable pedestrian environments with regionally distinctive landscapes.

Table2- 4 Content Framework of The Charter of the New Urbanism
(Source: Compiled by author)

Spatial Scale Hierarchy	**Development Pattern**	**Transportation Mode**	**Spatial Landscape**
Region: Metropolis, City, and Town	- Infill Development (Prioritize Use of Existing Urban Areas) - Defined Geographic Boundaries (Natural Features such as Water Bodies and Farmland) - Jobs-Housing Balance and Tax Revenue Sharing	- Regional Public Transit Networks (Bus, Walking, Bicycles) - Reduced Reliance on Private Cars - Coordinated Transportation Framework with Shared Infrastructure	- Natural Geographic Boundaries (Mountains, Rivers) - Preservation of Farmland and Natural Landscapes - Continuity and Restoration of Historical Heritage
Neighborhood, District, and Corridor	- Compact Mixed-Use Development (Residential, Commercial, Public Services) - Diverse Housing Types (Mixed Age and Income Groups)	- Connected Street Network (Encouraging Walkability) - Within Walking Distance to Bus Stops - Corridor Connectivity	- Distribution of Parks and Community Gardens - Open Spaces Defining Neighborhood Boundaries - Corridor Landscapes

Spatial Scale Hierarchy	Development Pattern	Transportation Mode	Spatial Landscape
	- Walkable Access to Public Amenities	(Boulevards, Railways, Rivers)	(Greenbelts, Water Features)
Block, Street, and Building	- Multi-use Streets and Public Spaces - Architecture Reflecting Local Climate, History, and Topography - Design Balancing Safety and Openness	- Pedestrian-Priority Streets (Safe and Comfortable) - Balancing the Needs of Cars and Pedestrians (Reducing Traffic Fragmentation)	- Historic Building and District Preservation - Design for Natural Lighting and Ventilation - Civic Buildings Highlight Community Identity

(2)Integration of SmartCode Spatial Framework

With the introduction of transect theory, the three spatial scales of region, neighborhood, and street have been further integrated into the framework of the SmartCode (as shown in Figure 2-22). This integration refines the spatial typologies across the three scales from the perspectives of locational characteristics, urban-rural spatial form, and patterns of preservation and development. These scales are nested layer by layer, with transect zones providing clear form definitions for spatial control. At the regional level, development and growth objectives are defined. At the community scale, development types are further specified, leading to the delineation of concrete transect zones. Finally, the implementation of various codes enables the realization of the envisioned development. This also signifies the transformation of New Urbanism's theoretical principles into a technical system—a practical toolkit that more effectively guides spatial design and control.

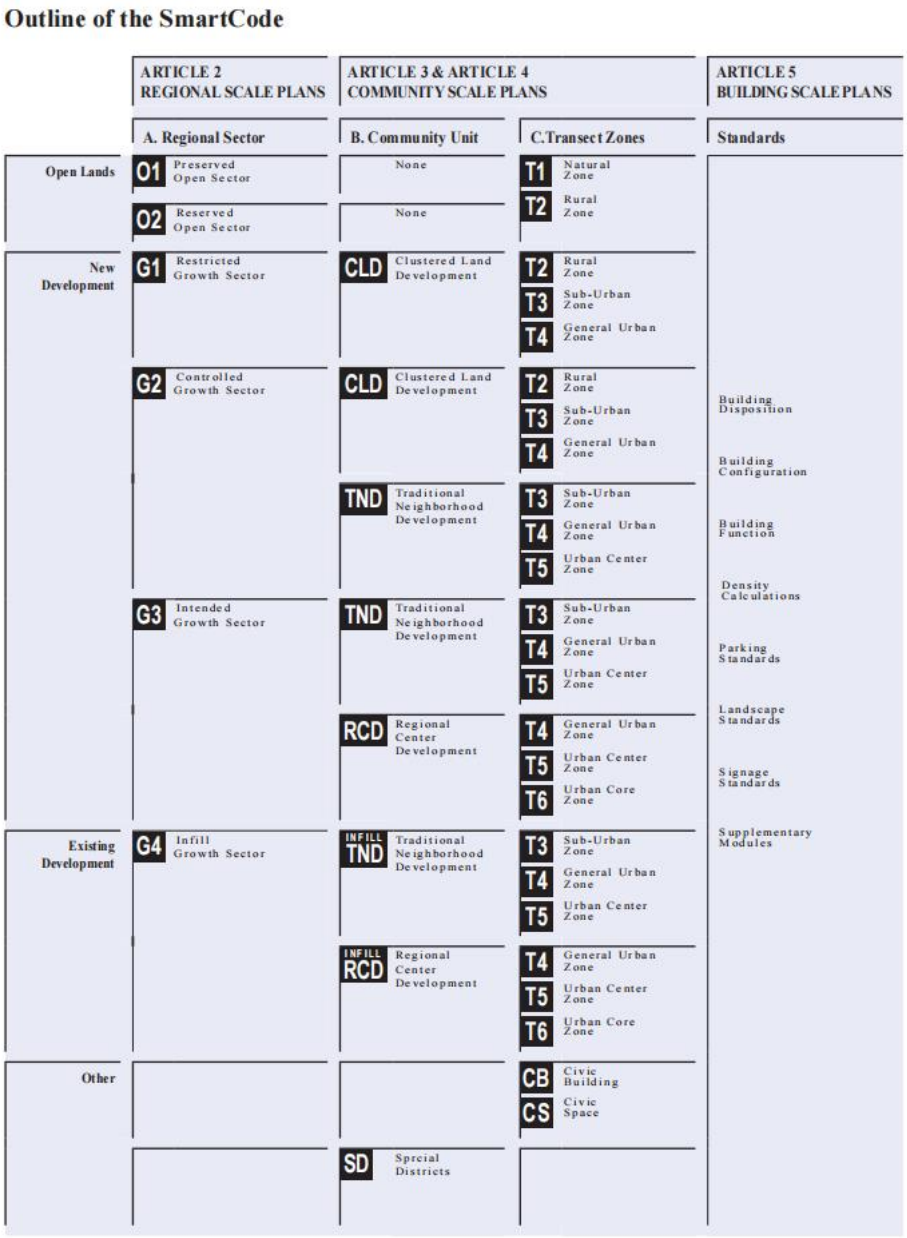


Figure2- 22 Content Framework of the SmartCode

(Source: Reference[20])

(3)Three Key Spatial Elements for Control

Beyond the concept of transects, New Urbanism emphasizes three core elements in urban development and redevelopment: neighborhoods, districts, and corridors.[16] Neighborhood: The basic unit in town planning, generally referring to an area covered by a 5-minute walking radius. It has clearly defined centers and edges, a complete street network, and a mix of housing types and uses. In more urbanized neighborhoods, municipal or public buildings hold prominent positions, and communities are typically composed of multiple neighborhoods integrated via street networks. Special District: Areas designated for a single

purpose. Typically, two types exist in towns: single-use districts such as campuses, and incompatible-use districts like airports or large industrial zones. Corridor: This does not simply mean automobile traffic corridors; more importantly, it considers pedestrian flow and connectivity. Corridors also serve as physical boundaries defining neighborhoods and special districts within communities. Corridors may include natural and man-made elements, ranging from wildlife paths to railway lines. In practice, some corridors may become centers of linear neighborhoods rather than merely their boundaries. [39]

The core of form-based codes is to understand and control these three spatial elements, delineating their extents to build an overall framework for urban form structure. The overlay of these three spatial elements on a plan results in the regulating plan, which both reflects the generation of form-based zones and becomes the core outcome of form control. For example, in the Azusa Form-Based Code (FBC), the zones are divided into four types: neighborhood, corridor, district, and open space, forming the core framework for form control. Within the district type, areas dominated by specific functions are designated, such as the University District and the Western Industrial District. Corridors are often defined along major roads, considering building form and uses on both sides. For instance, the code describes the development intent for San Gabriel Avenue: “CSG (San Gabriel Corridor): The San Gabriel Corridor (CSG)zone applies to the portion of San Gabriel Avenue adjacent to the Azusa Avenue/San Gabriel Avenue intersection, close to the Downtown-Town Center (DTC)zone. This area emphasizes residential rather than commercial development but includes office and other low-density commercial uses, excluding most retail. All types of residential units are permitted except stacked apartments.” This abstract understanding of form elements transcends the limitations of function-based approaches.

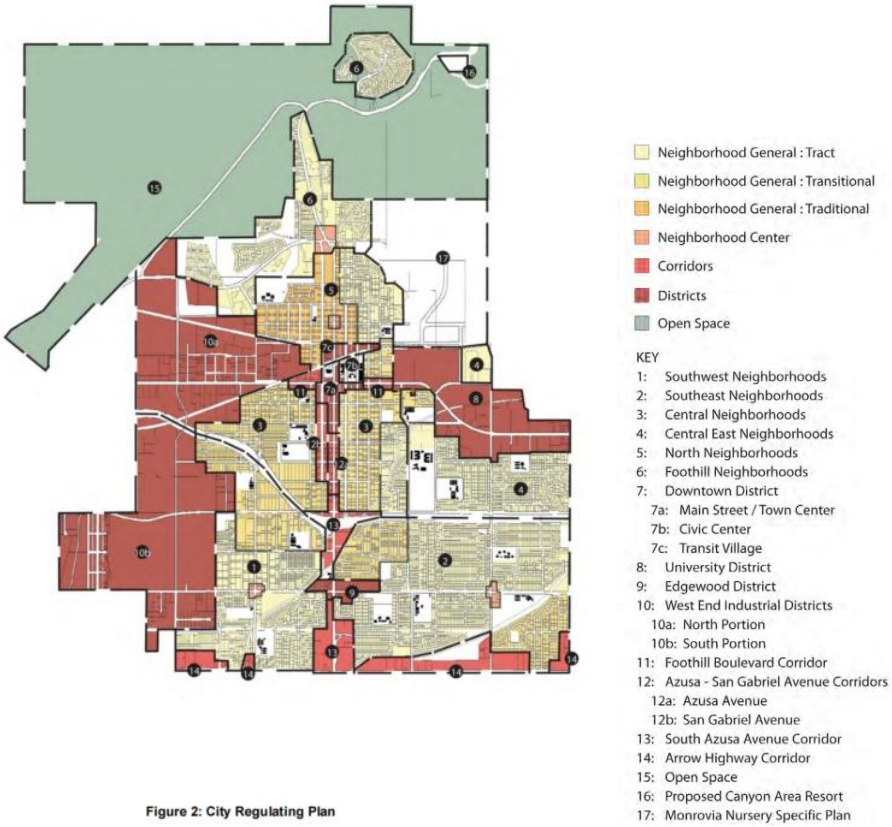


Figure2- 23 Azusa Form-Based Regulating Plan
(Source: Azusa Development Code)

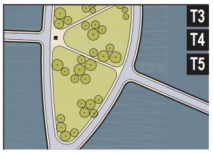
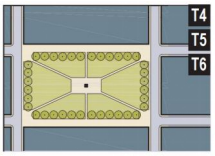
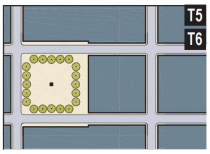
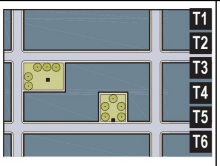
2.3.3 Public Space Quality Control as the Core Objective

Continuing the principles of New Urbanism, form-based codes also prioritize the regulation of public space as a central goal. The New Urbanism Charter states, “Public buildings and civic spaces need to occupy prominent positions to help communities form identity and culture. They must have distinguished forms, different from the ordinary buildings and places that make up the urban fabric.” (Charter)The control of public space in form-based codes mainly includes two parts: civic spaces and thoroughfares.

(1) Civic Space Standards: A Systematic Public Space Framework

Civic spaces generally refer to outdoor areas designed to accommodate various activities, including parks, green spaces, plazas, markets, promenades, pocket parks, and other open spaces of varying scales and forms. Well-designed civic spaces play a vital role in creating vibrant neighborhoods. Form-based codes provide a systematic framework for civic spaces that, according to different transect zones T1-T6, specify spatial types, area requirements, layout criteria, capacity for activities, and general characteristics, as illustrated in Table 2-5.

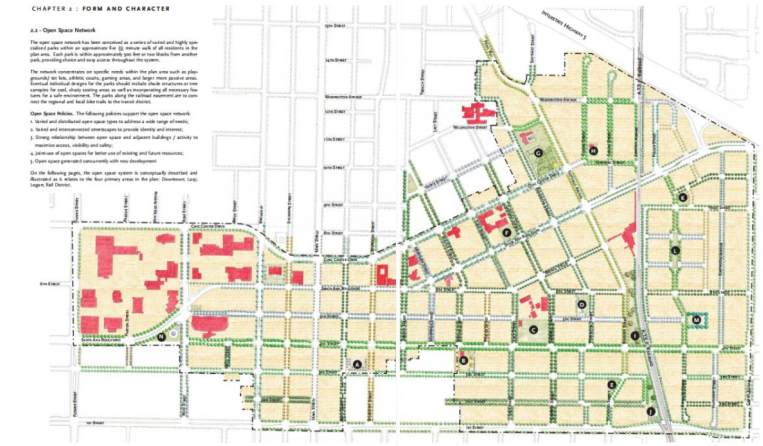
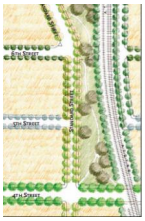
Table2- 5 Civic Space Framework in Form-Based Codes
(Source: Reference[20])

Space Category	Regulating Plan Illustration	Landscape Elements and form Features	Scale	Suitable Activities
Park		Natural-form walking paths, trails, lawns, water bodies, woodlands, and open sheltered areas. Parks distributed linearly along natural corridors	Minimum size: 8 acres	Spaces for spontaneous recreational activities
Green space		Natural-form planted lawns and trees Green spaces can shape the space through landscaping rather than building street frontage	Minimum size: 0.5 acres Maximum size: 8 acres	Spaces for spontaneous recreational activities
Plaza		Formal, artificially designed walking paths, lawns, and trees Squares should be located at the intersections of major roads	Minimum size: 0.5 acres Maximum size: 5 acres	Open spaces for spontaneous recreational activities and public events
Small plaza		Preferably located at intersections of major streets	Minimum size: 0.5 acres Maximum size: 2 acres	Spaces for public activities and commercial activities
Children's playground		Play areas for children should preferably be fenced and may include open shelters. They should be distributed within residential neighborhoods and can be located inside blocks.	No size restrictions.	Suitable for children's play and sports activities.

Form-Based Codes advocate that these spaces be located within a walkable radius of primary living areas to enhance accessibility and ease of use, and that spatial scale should be defined and adapted according to the location of civic spaces within the neighborhood[41]. For example, the Santa Ana FBC establishes an open space system reachable within a 5-minute walk for all residents. It configures civic spaces with corresponding functions based on nearby buildings, providing various types of open spaces such as parks, plazas, green spaces, and sports fields. The guidelines ensure that these open spaces meet intended characteristics by including features like plant shading and seating, thereby protecting and creating

important public places.

Table2- 6 Civic Space Planning in the Santa Ana Code
(Source: Santa Ana Renaissance Specific Plan)

Open Space Site Plan	Node 1	Node 2
	 	 

(2) Systematic Design of Streets as Important Open Spaces

In form-based codes, the term "corridor" is a technical term referring to public spaces primarily dominated by conventional traf fic, serving both motor vehicles and pedestrian pathways. Since the theoretical foundation of New Urbanism, streets have been regarded as vital public spaces. The traditional neighborhood development model (TND)establishes a neighborhood scale based on a 5-minute (400m)walking radius, emphasizing that communities should have interconnected street networks. Streets are designed to be as narrow as possible to slow vehicle speeds while balancing the needs of both pedestrians and vehicles, thereby creating safe and comfortable walking environments. Additionally, streets serve as crucial connectors between neighborhood cores and different neighborhood units.

The code clearly defines a spatial framework for street types and proposes control methods for street spaces from multiple dimensions such as streets, buildings, and interfaces. For example, the Akanda SmartCode designs six street types corresponding to six transect zones (T1 – T6). The code specifies dimensions for lanes, sidewalks, parking spaces, and other street elements, visually representing the spatial form of streets through sectional perspective diagrams.

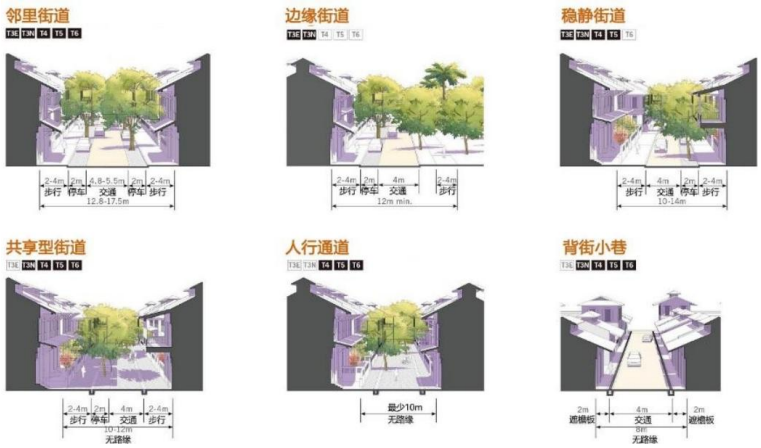


Figure2- 24 Illustration of Street Standards in the Akanda SmartCode
(Source: Akanda SmartCode)

Beyond direct design standards for street spaces, form-based codes also incorporate a multi-dimensional street control framework involving buildings, interfaces, and more. A pioneering concept introduced by form-based codes is the Building-to-Line (BTL), which controls the distance from the property line or right-of-way (ROW)to the building façade (BTL), as shown in Figure 2-25. This standard regulates the consistency of public-facing building facades along corridors, parks, and alleys. [38]Together with building height controls (see Figure 2-25 right), this approach helps establish well-proportioned, comfortable, and pedestrian-friendly street environments. By limiting the location of building façades, form-based codes create predictable and coherent street spatial forms.

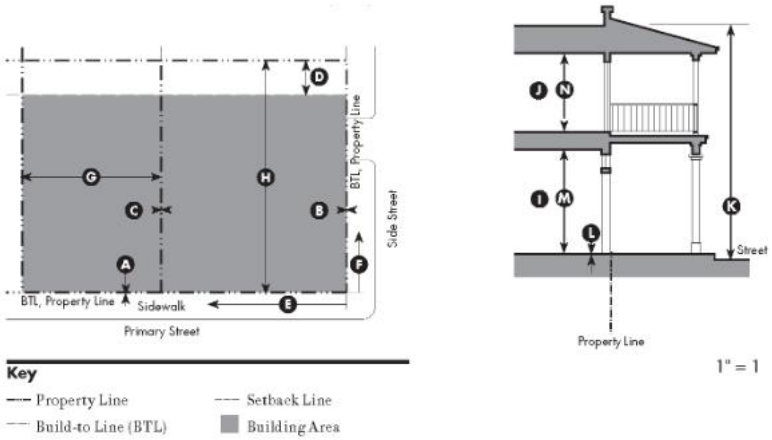


Figure2- 25 Plan and Section Requirements for Building Layout in the TC District of Grass Valley

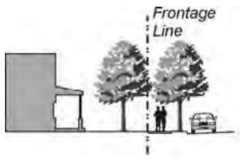
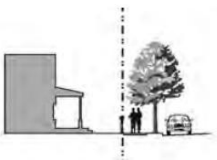
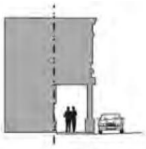
(Source:

https://library.municode.com/ca/grass_valley/codes/code_of_ordinances?nodeId=TIT17DECO_ART2ZOALUSZOST)

Beyond controlling parameters such as building street walls and building heights,

form-based codes also establish the spatial relationship between buildings (private realm)and streets (public realm)through the types of building ground floors. For example, the Azusa Form-Based Code (Azusa FBC)defines seven types of building frontages to correspond with the development requirements of different districts. In general neighborhood zones, ground-floor interfaces such as front yards with setbacks are used, where buildings should not be set back too far to maintain effective massing that contributes to the street frontage and ensures neighborhood character harmony. Transitional elements like porches and balconies help delineate the boundary between public and private spaces. In town center zones, ground floors adopt setback-free forms such as arcades or storefronts, establishing both behavioral and visual connections between the public and private realms to ensure street vitality and continuity.

Table2- 7 Types of Ground-Floor Building Frontages in Azusa Form-Based Code
(Source: Azusa Development Code)

Standard Yard	Porch	Front Yard	Setback
			
Street-facing	Porch	Arcade	
			

(3) Ensuring Spatial Transition from Regional to Building Scale

Form-based codes replace the boundary control typical of traditional zoning with a transitional regional control approach. They understand urbanization intensity as a continuous gradient from rural to highly urbanized areas, rather than isolating individual urban zones. With the introduction of the transect concept, the spatial transition idea embedded in form-based codes becomes more systematic. The transect establishes an intrinsic ecological and physical relationship within the environment, integrating the human-nature connection into the geographic landscape, rather than simply defining zones from a form perspective.[54]

Form-based codes emphasize first identifying land that is unsuitable for development. For lands where new development, increased density, or redevelopment is permitted,

form-based codes establish a hierarchical development framework to achieve the goal of spatial transition.

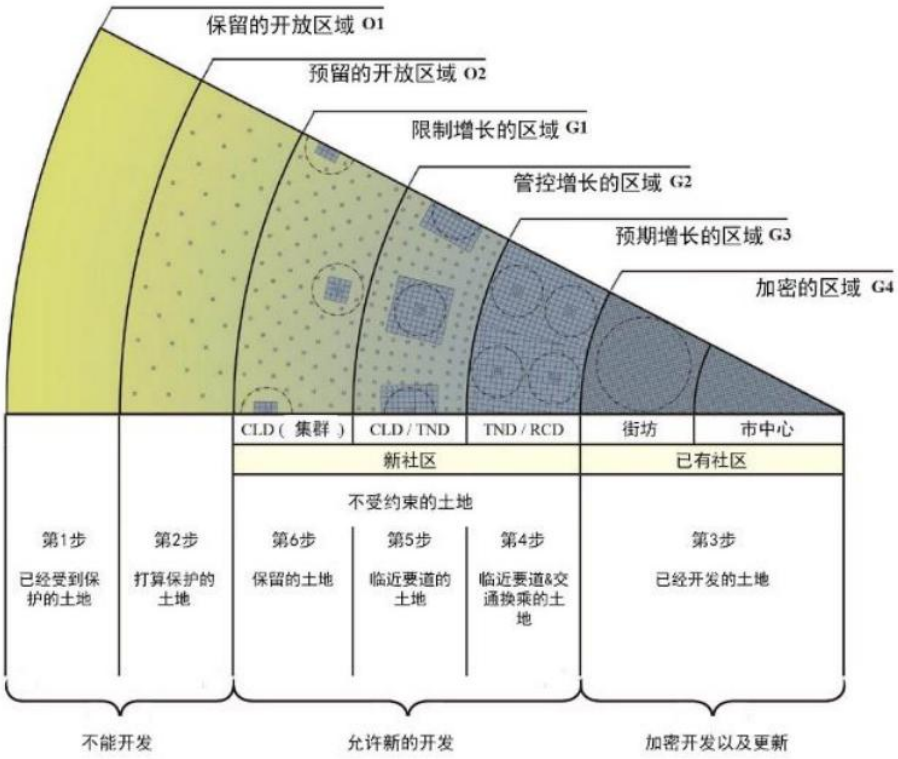


Figure2- 26 Flowchart of SmartCode Determining Regional Development Patterns
(Source: Reference[20])

In practical cases, the initial goal of formulating the Miami 21 code was to balance the spatial morphology between the high-density urban core and single-family residential neighborhoods.



Figure2- 27 Transition Vision Proposed by Miami 21 Between High-Density Areas and Single-Family Homes
(Source: Reference[41])

2.4 Advantages and Potential of Form-Based Codes — Comparison with China's System

2.4.1 Form-Based Codes Are Applicable to More Diverse Scenarios

(1)Urban design is entering an era of infill development, while the existing urban design system struggles to cope with complex and varied scenarios

- Complexity in the Infill Era

China's current detailed regulatory planning system is derived from the U.S., internalizing the American zoning system's "use-based zoning" into "functional zoning," where each parcel corresponds to a single function. This method is quite efficient in guiding land grants for new urban districts and usually does not face complicated property ownership issues. However, as urban development shifts towards infill renewal, existing built environments often contain parcels comprising multiple land lots and various mixed uses. Traditional planning methods based on land grants and single-use zoning need to shift to an approach led by property parcels, respecting the existing spatial form characteristics and usage habits.[4]

China's current urban design guidelines represent a generalized technical system, whereas the types of development in the infill era are becoming more diverse. Projects like "urban repairs," "micro-renovations," and "partial reconstructions" often appear singly or in combination. Under such complexity, a more adaptable urban design technical system is needed, one that considers issues based on local conditions.

- Urban Design Focuses on Key Areas with Insufficient Control Over General Areas

In Shenzhen, urban design control has followed the three stages of "design competitions — statutory planning preparation — planning implementation," which is typical for key areas' urban design control in China.[11]Regarding control objects, urban design often inherits and focuses on key areas identified in overall urban plans. For example, the Guangzhou Urban Design Guidelines set urban design guidance requirements for four key scenic areas: historic and cultural districts, public gateway scenic zones, modern axis scenic zones, and Pearl River landscape zones.

These key urban development areas usually reflect administrative intentions, with government-led tenders and significant investment in planning and construction. For example,

the concept planning international consultation for Shenzhen's Qianhai area was held in 2010, where James Corner's "Qianhai Water City" plan won. In 2013, Shenzhen prepared the "Comprehensive Plan for Qianhai Shenzhen-Hong Kong Modern Service Industry Cooperation Zone," converting the competition scheme into a statutory regulatory plan.

However, for the vast general urban areas, regulatory plans usually directly guide land grants and development design, but there is insufficient overall urban design and landscape control.

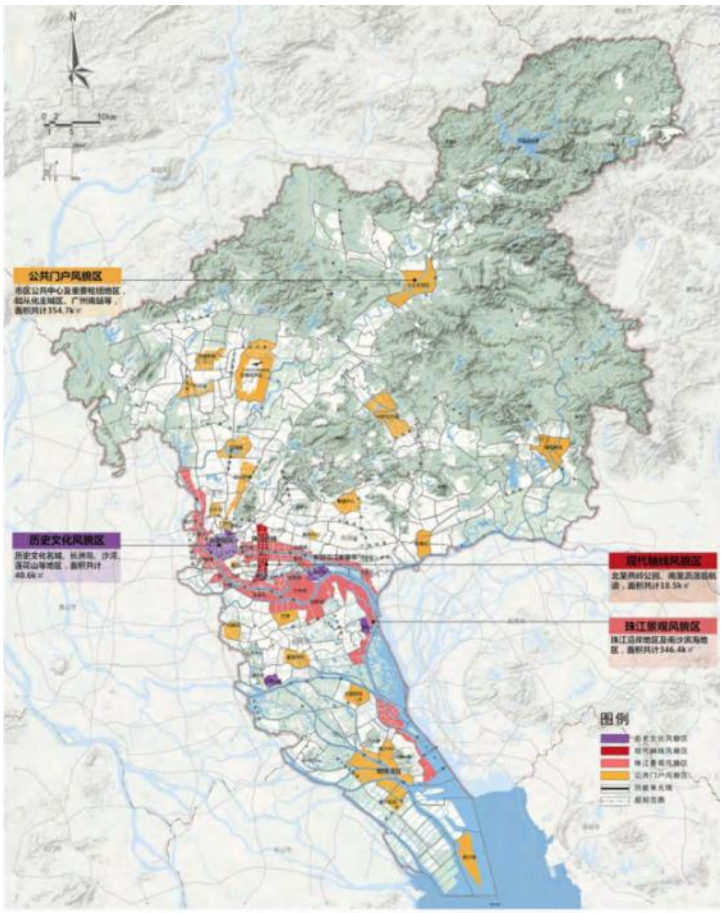


Figure2- 28 Control Map of Key Urban Design Areas in Guangzhou
(Source: Guangzhou Urban Design Guidelines)



Figure2- 29 Qianhai Water City Master Plan
(Source: Shenzhen Planning and Natural Resources Commission)



Figure2- 30 Land Use Plan of Qianhai Shenzhen-Hong Kong Modern Service Industry Cooperation Zone
(Source: Shenzhen Planning and Natural Resources Commission)

(2)Broader Applicability of Form-Based Codes

Form-based codes in the United States have undergone over 30 years of development and evolution. They have a wide range of applicability: Scale: Form-based codes can be applied to large cities, small and medium-sized cities, regional and cross-regional developments, and community-scale developments. Development Types: They can be used

for new community development, infill development, greyfield redevelopment, and various other development types. In the context of the infill era, existing built environments often contain multiple functions, multiple land lots, and multiple stakeholders within a single parcel. The development approach of form-based codes can better adapt to such complex realities. These relevant cases also provide excellent examples for the transformation of urban design and development in China.

2.4.2 Form-Based Codes Emphasize Morphology-Oriented Control Content

Control Content of Form-Based Codes: Indicators / form Elements

In China’s combined system of regulatory planning plus urban design guidelines, urban design generally follows three stages: "design competition — statutory planning preparation — planning implementation." Ideal urban design schemes are translated into statutory plans and implemented through guidance and control on specific parcels. However, the control content still mainly relies on quantitative indicators, including Floor Area Ratio (FAR), building density, complemented by form controls such as setbacks, build-to lines, and building control boundaries. “This approach causes urban design outcomes to remain constrained by functional zoning, disrupting the internal wholeness and structural coherence of morphology.”[4]

*The Shanghai Detailed Regulatory Planning Deliverables Specification (2020 Trial Version)*adds supplemental urban design guidelines on top of the universal urban design guidelines. For example, these supplemental guidelines enrich the representation of public corridors, connecting passages, bridges, plazas and greenery, building forms, and layered facility space ranges on urban design control maps (see Figures 2-31)[44] These further refine and supplement the form control in urban design guidelines. However, the core logic of control still centers on quantitative indicators.

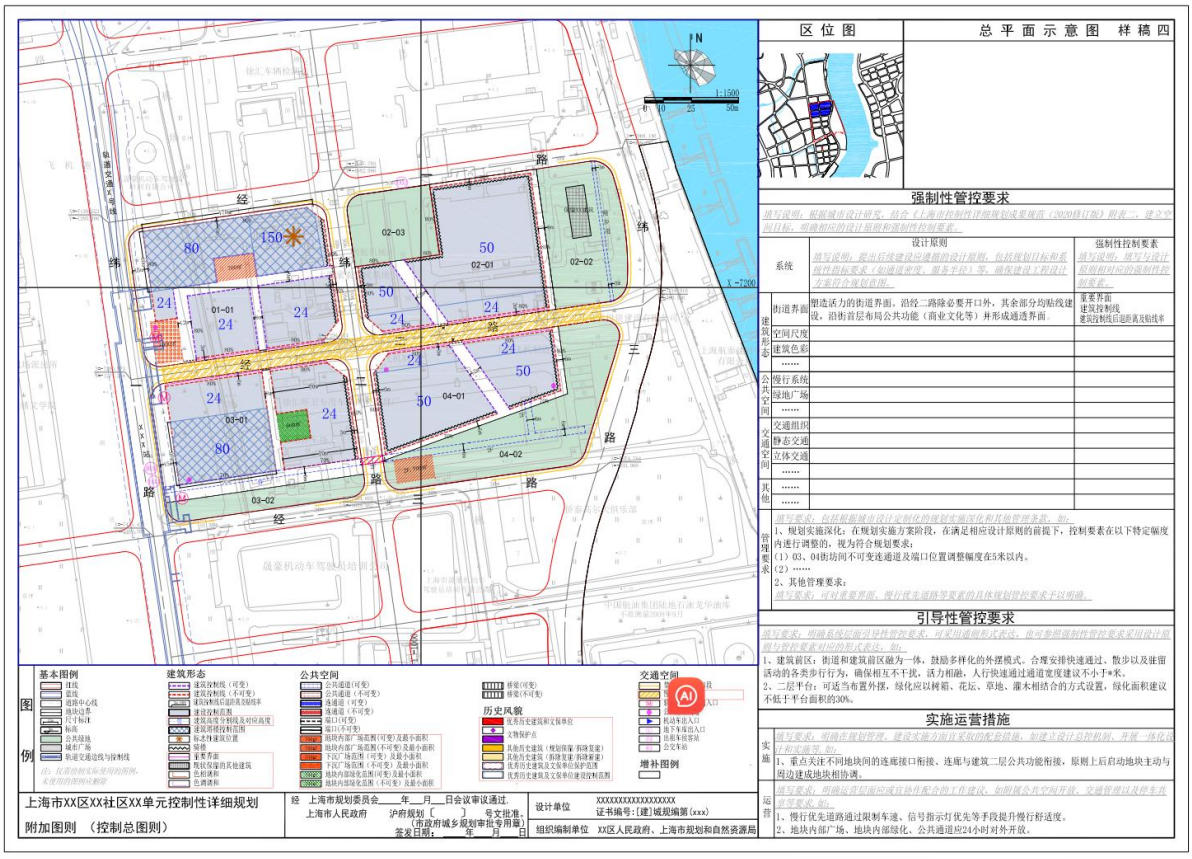
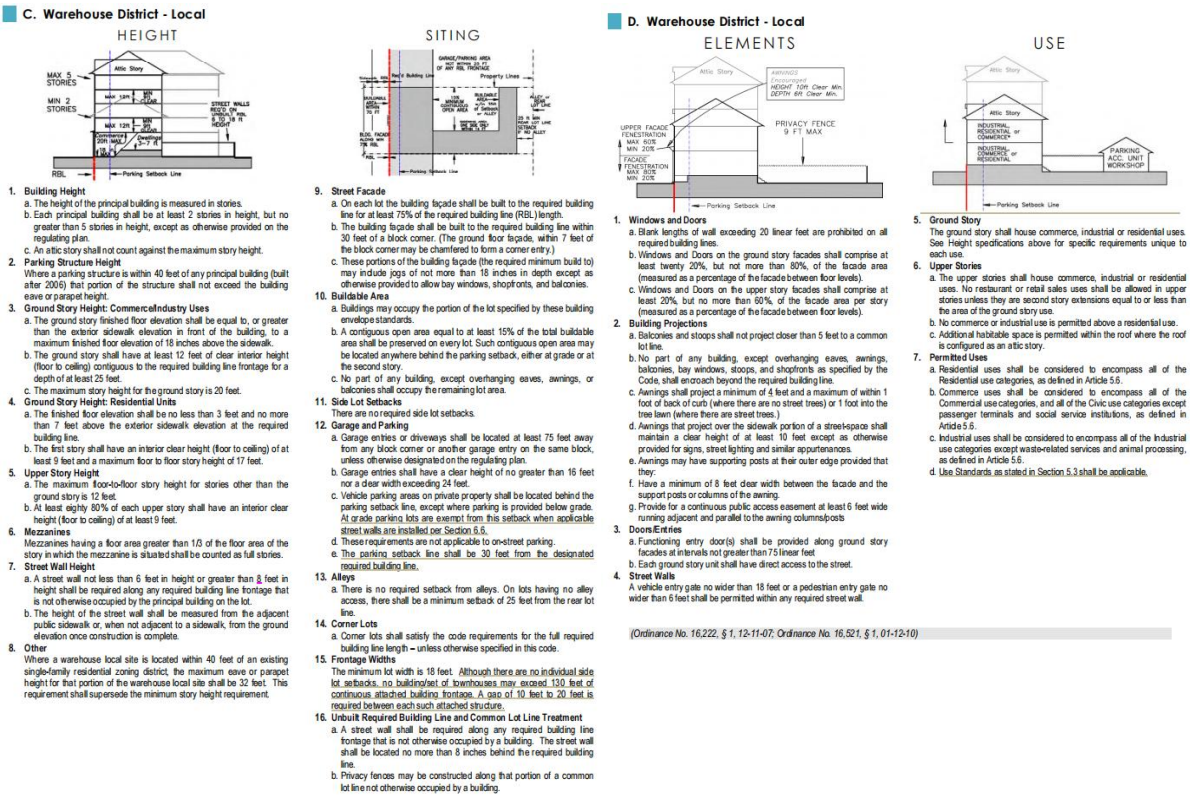


Figure2- 31 Supplemental Diagrams from the *Shanghai Detailed Regulatory Planning Deliverables Specification (2020 Trial Version)*

(Source: Shanghai Municipal Bureau of Planning and Natural Resources)

In contrast, form-based codes start from the control of spatial elements and consider the combined effects of multiple components to establish a comprehensive set of design regulations. For example, the Peoria Downtown Development Code adopts frontage regulations as its organizing principle. The code focuses on revitalizing pedestrian-oriented commercial street frontages, taking into account multiple elements such as ground floor building interfaces, sidewalks, street trees, and street furniture. Together, these shape the street interface and help revive historic streetscapes.



C. Warehouse District - Local

HEIGHT

SITING

1. **Building Height**
   a. The height of the principal building is measured in stories.
   b. Each principal building shall be at least 2 stories in height, but no greater than 5 stories in height, except as otherwise provided on the regulating plan.
   c. An attic story shall not count against the maximum story height.
2. **Parking Structure Height**
   Where a parking structure is within 40 feet of any principal building (built after 2006) that portion of the structure shall not exceed the building eave or parapet height.
3. **Ground Story Height: Commerce/Industry Uses**
   a. The ground story finished floor elevation shall be equal to, or greater than the exterior sidewalk elevation in front of the building, to a maximum finished floor elevation of 18 inches above the sidewalk.
   b. The ground story shall have at least 12 feet of clear interior height (floor to ceiling) contiguous to the required building line frontage for a depth of at least 25 feet.
   c. The maximum story height for the ground story is 20 feet.
4. **Ground Story Height: Residential Units**
   a. The finished floor elevation shall be no less than 3 feet and no more than 7 feet above the exterior sidewalk elevation at the required building line.
   b. The first story shall have an interior clear height (floor to ceiling) of at least 9 feet and a maximum floor to floor story height of 17 feet.
5. **Upper Story Height**
   a. The maximum floor-to-floor story height for stories other than the ground story is 12 feet.
   b. At least eighty 80% of each upper story shall have an interior clear height (floor to ceiling) of at least 9 feet.
6. **Mezzanines**
   Mezzanines having a floor area greater than 1/3 of the floor area of the story in which the mezzanine is situated shall be counted as full stories.
7. **Street Wall Height**
   a. A street wall not less than 6 feet in height or greater than 8 feet in height shall be required along any required building line frontage that is not otherwise occupied by the principal building on the lot.
   b. The height of the street wall shall be measured from the adjacent public sidewalk or, when not adjacent to a sidewalk, from the ground elevation once construction is complete.
8. **Other**
   Where a warehouse local site is located within 40 feet of an existing single-family residential zoning district, the maximum eave or parapet height for that portion of the warehouse local site shall be 32 feet. This requirement shall supersede the minimum story height requirement.
9. **Street Facade**
   a. On each lot the building façade shall be built to the required building line for at least 75% of the required building line (RBL) length.
   b. The building façade shall be built to the required building line within 30 feet of a block corner. (The ground floor façade, within 7 feet of the block corner may be chamfered to form a corner entry.)
   c. These portions of the building façade (the required minimum build to) may include jogs of not more than 18 inches in depth except as otherwise provided to allow bay windows, shopfronts, and balconies.
10. **Buildable Area**
    a. Buildings may occupy the portion of the lot specified by these building envelope standards.
    b. A contiguous open area equal to at least 15% of the total buildable area shall be preserved on every lot. Such contiguous open area may be located anywhere behind the parking setback, either at grade or at the second story.
    c. No part of any building, except overhanging eaves, awnings, or balconies shall occupy the remaining lot area.
11. **Side Lot Setbacks**
    There are no required side lot setbacks.
12. **Garage and Parking**
    a. Garage entries or driveways shall be located at least 75 feet away from any block corner or another garage entry on the same block, unless otherwise designated on the regulating plan.
    b. Garage entries shall have a clear height of no greater than 16 feet nor a clear width exceeding 24 feet.
    c. Vehicle parking areas on private property shall be located behind the parking setback line, except where parking is provided below grade. At grade parking lots are exempt from this setback when applicable street walls are installed per Section 5.6.
    d. These requirements are not applicable to on-street parking.
    e. The parking setback line shall be 30 feet from the designated required building line.
13. **Alleys**
    a. There is no required setback from alleys. On lots having no alley access, there shall be a minimum setback of 25 feet from the rear lot line.
14. **Corner Lots**
    a. Corner lots shall satisfy the code requirements for the full required building line length – unless otherwise specified in this code.
15. **Frontage Widths**
    The minimum lot width is 18 feet. Although there are no individual side lot setbacks, no building/set of townhouses may exceed 130 feet of continuous attached building frontage. A gap of 10 feet to 20 feet is required between each such attached structure.
16. **Unbuilt Required Building Line and Common Lot Line Treatment**
    a. A street wall shall be required along any required building line frontage that is not otherwise occupied by a building. The street wall shall be located no more than 8 inches behind the required building line.
    b. Privacy fences may be constructed along that portion of a common lot line not otherwise occupied by a building.

D. Warehouse District - Local

ELEMENTS

USE

1. **Windows and Doors**
   a. Blank lengths of wall exceeding 20 linear feet are prohibited on all required building lines.
   b. Windows and Doors on the ground story facades shall comprise at least twenty 20%, but not more than 80%, of the facade area (measured as a percentage of the facade between floor levels).
   c. Windows and Doors on the upper story facades shall comprise at least 20%, but no more than 60%, of the facade area per story (measured as a percentage of the facade between floor levels).
2. **Building Projections**
   a. Balconies and stoops shall not project closer than 5 feet to a common lot line.
   b. No part of any building, except overhanging eaves, awnings, balconies, bay windows, stoops, and shopfronts as specified by the Code, shall encroach beyond the required building line.
   c. Awnings shall project a minimum of 4 feet and a maximum of within 1 foot of back of curb (where there are no street trees) or 1 foot into the tree lawn (where there are street trees.)
   d. Awnings that project over the sidewalk portion of a street-space shall maintain a clear height of at least 10 feet except as otherwise provided for signs, street lighting and similar appurtenances.
   e. Awnings may have supporting posts at their outer edge provided that they:
   f. Have a minimum of 8 feet clear width between the facade and the support posts or columns of the awning.
   g. Provide for a continuous public access easement at least 6 feet wide running adjacent and parallel to the awning columns/posts
3. **Doors/Entries**
   a. Functioning entry door(s) shall be provided along ground story facades at intervals not greater than 75 linear feet
   b. Each ground story unit shall have direct access to the street.
4. **Street Walls**
   A vehicle entry gate no wider than 18 feet or a pedestrian entry gate no wider than 6 feet shall be permitted within any required street wall.

5. **Ground Story**
   The ground story shall house commerce, industrial or residential uses. See Height specifications above for specific requirements unique to each use.
6. **Upper Stories**
   a. The upper stories shall house commerce, industrial or residential uses. No restaurant or retail sales uses shall be allowed in upper stories unless they are second story extensions equal to or less than the area of the ground story use.
   b. No commerce or industrial use is permitted above a residential use.
   c. Additional habitable space is permitted within the roof where the roof is configured as an attic story.
7. **Permitted Uses**
   a. Residential uses shall be considered to encompass all of the Residential use categories, as defined in Article 5.6.
   b. Commerce uses shall be considered to encompass all of the Commercial use categories, and all of the Civic use categories except passenger terminals and social service institutions, as defined in Article 5.6.
   c. Industrial uses shall be considered to encompass all of the Industrial use categories except waste-related services and animal processing, as defined in Article 5.6.
   d. Use Standards as stated in Section 5.3 shall be applicable.

(Ordinance No. 16,222, § 1, 12-11-07; Ordinance No. 16,521, § 1, 01-12-10)

Figure2- 32 Excerpt from Peoria Form-Based Code
(Source: Heart of Peoria Land Development Code)



Figure2- 33 Regulating Plan of Peoria
(Source: Heart of Peoria Land Development Code)

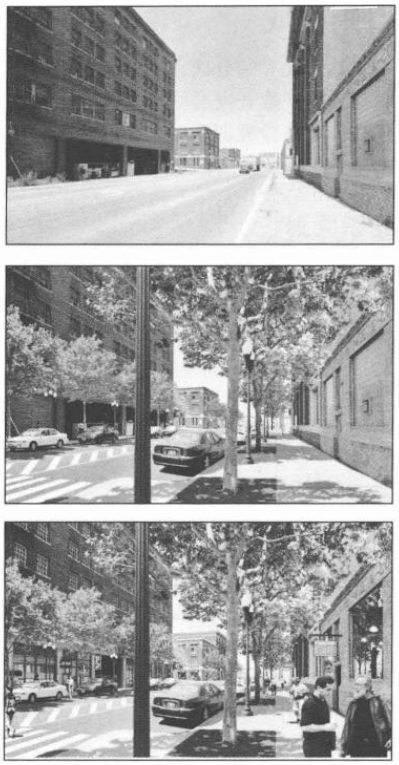


Figure2- 34 Design Before and After of the Peoria Warehouse District
(Source: Heart of Peoria Land Development Code)

In terms of how design outcomes are presented, urban design schemes in China are primarily expressed through regulatory planning diagrams, which still largely remain at the level of two-dimensional functional control. Urban design guidelines are mostly delivered in lengthy textual formats filled with technical terminology, specialized indicators, and exhaustive regulations (see Figure 2-35). This is essentially a form of graphic language intended for planners and architects, and is not suitable for public audiences. As a result, the general public struggles to quickly and effectively grasp the intended spatial outcomes of the design.

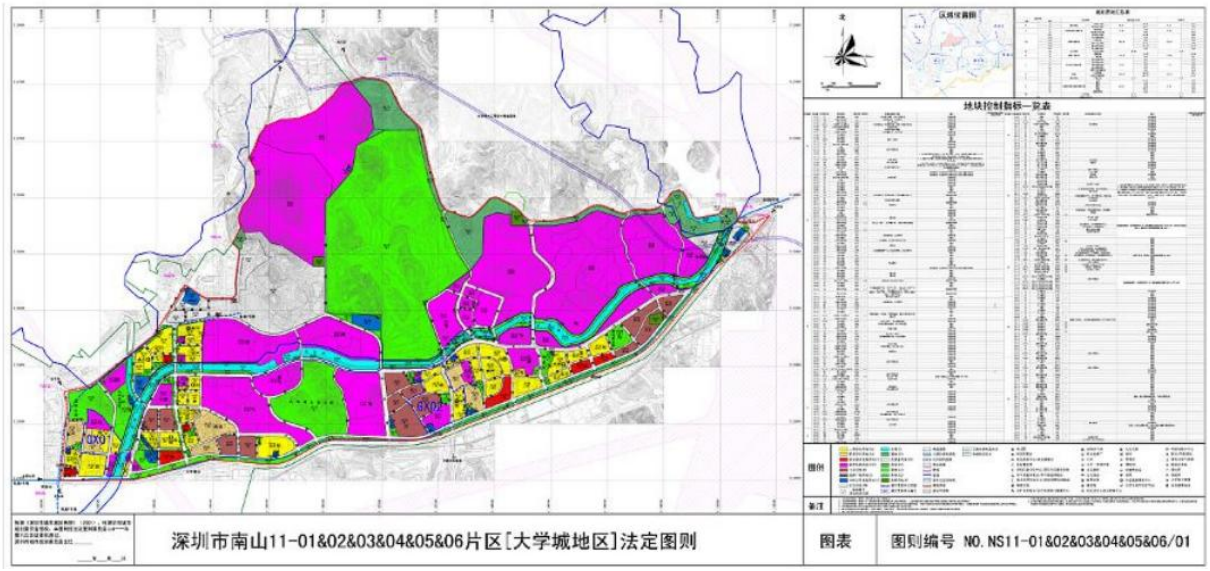


Figure2- 35 Public Display of a Typical Statutory Planning Diagram in Shenzhen
(Source: Statutory Plan of University Town Area, Nanshan District, Shenzhen)

Form-based codes are primarily composed of three parts: the Regulating Plan, Form Standards, and Administrative Procedures.

Compared to traditional regulatory planning, form-based codes emphasize both design vision and spatial regulations. In terms of design vision, a large number of perspective sketches are used to clearly show spatial changes before and after implementation. In the implementation standards section, three-dimensional illustrations—combining plan, elevation, and section views — are paired with textual regulations to form a comprehensive documentation set that is made available to the public. This presentation format helps the public form a complete understanding loop from design goals, through form control standards, to spatial outcomes, thereby strengthening local identity and public engagement.



Figure2- 36 Perspective Rendering in the Santa Ana City Plan

(Source: Santa Ana Renaissance Specific Plan)

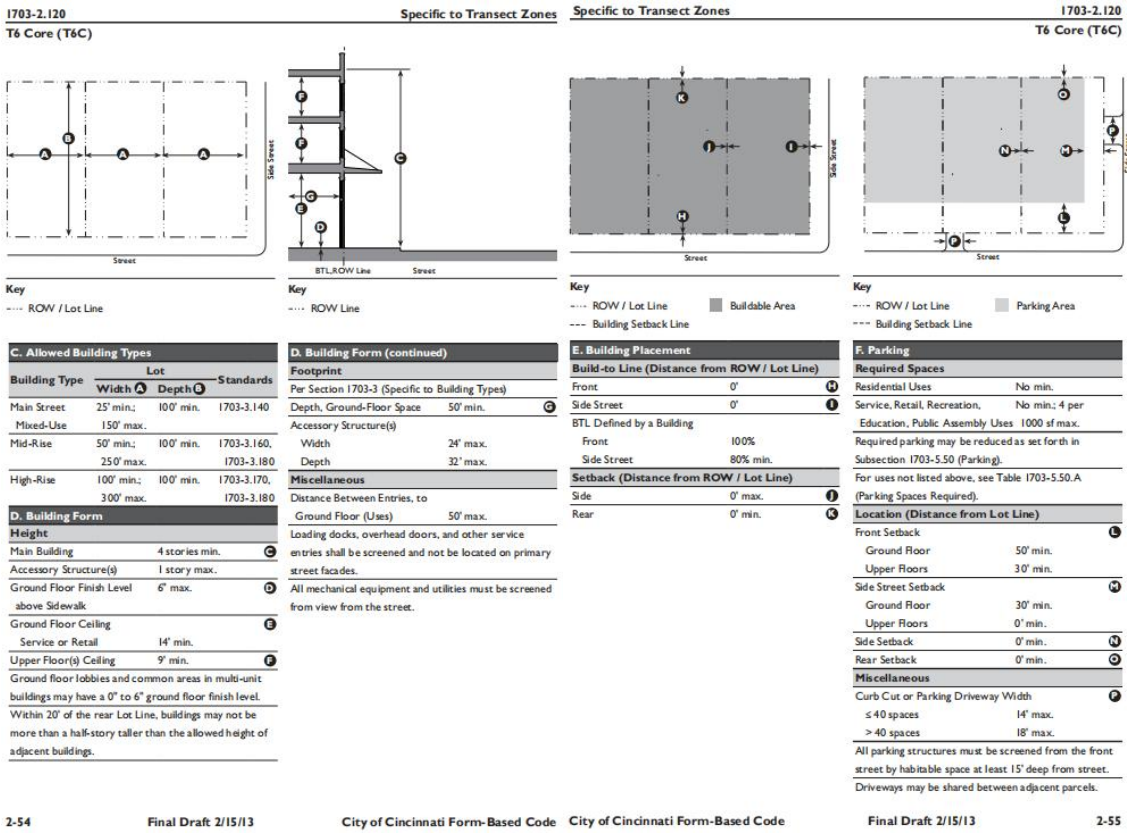


Figure2- 37 Two-Dimensional Illustration of Building Codes

(Source: Cincinnati Form-Based Code)

2.4.3 Form-Based Codes Provide More Precise Regulatory Control

The current regulatory planning + urban design guideline system in China still suffers from inconsistent control effectiveness. Although urban design guidelines are translated into regulatory indicators, in the actual construction process, market pressures and other non-design factors often weaken their enforcement power. In the Hengqin New Area of Zhuhai, for example, urban design control over elements such as building form layouts and second-floor pedestrian corridors has proven to be largely ineffective. On plot A401a0223, two additional residential tower buildings were added beyond the original design; on plots A401a0218 and A401a0215, one tower was split into two or three smaller towers(图 2-38)。[7]While these changes technically comply with the rigid regulatory indices, they significantly diverge from the intended spatial form. Interviews with planning officials revealed that the limited enforcement capacity of local authorities, strong market development pressures, and the lack of a robust expert review system meant that design codes had little authority over the actual architectural outcomes. In most cases, market logic prevailed.

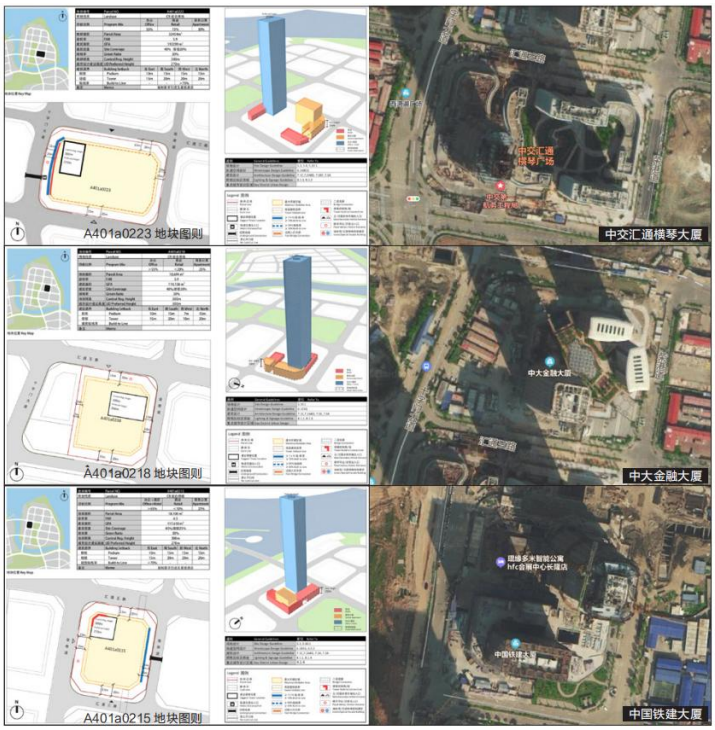


Figure2- 38 Comparison of Land Development and Urban Design Codes in Hengqin New Area, Zhuhai (Source: Reference[7])

Creating continuous street frontages and high-quality public spaces has always been a core objective of form-based codes (FBCs). The Downtown Montgomery Plan, a

comprehensive regulatory plan for Montgomery's city center, projected urban spatial outcomes under both traditional zoning and form-based codes. Under the functionally segregated logic of traditional zoning, newly constructed office towers would be disconnected from existing neighborhoods, contributing little to street-level vitality. In contrast, development guided by form-based codes is expected to foster urban communities and mixed-use centers, thereby accelerating urban growth, building cohesive and continuous public spaces, safeguarding the public interest, and creating neighborhoods that are more attractive, vibrant, and socially cohesive.

In this proposal, the implementation of form-based codes acts as a bridge between developers and local authorities, reducing approval timelines, enhancing investment appeal, and lowering the time and uncertainty costs of the approval process.[41] This approach helps to establish a clearly defined and predictable spatial form with strong enforceability.

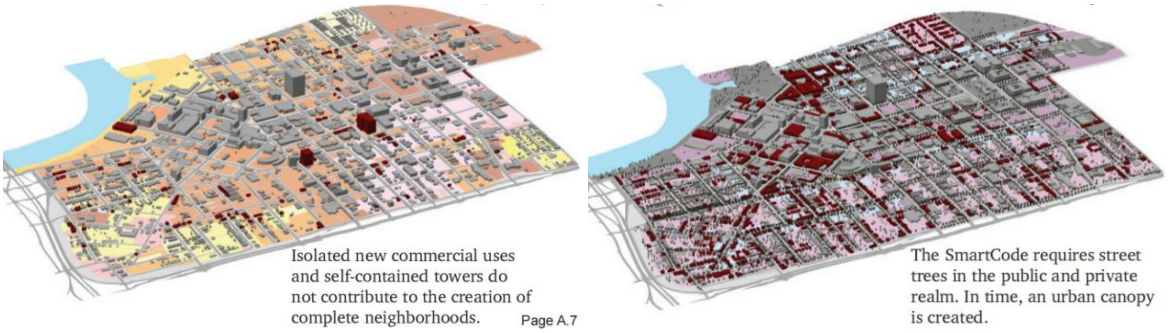


Figure2- 39 Urban Form Forecast Comparison Between Form-Based Codes and Traditional Zoning in Montgomery

(Source: Downtown Montgomery Plan)

2.4.4 Full-Process Public Participation in Form-Based Codes

In China's current urban design practices, public participation is typically limited to the post-design disclosure phase, during which the public is invited to comment on nearly finalized design outcomes.[11]At this stage, the design is mostly fixed, leaving little room for meaningful adjustment. If public opinions strongly conflict with the proposed plan, it often results in tension or symbolic revisions, offering little genuine improvement. Due to information asymmetry, the public may find it hard to provide constructive input. Moreover, the absence of an effective interest coordination mechanism—with conflicting demands from developers, government agencies, and residents—can hinder consensus-building and may lead to disputes during implementation.

In contrast, form-based codes (FBCs)emphasize openness and full-process public engagement throughout both the drafting and implementation phases. Starting from the Seaside town project, on-site design charrettes have been widely used as a method for gathering input from various stakeholders. This approach has since become a standard practice in FBC formulation. Its primary goal is to reach a clear, consensus-based community vision, which in turn facilitates the realization of predictable physical outcomes.

This vision-building process is rooted in local character studies and is shaped through collaborative efforts among project teams and stakeholders — including developers, government, and residents—during multi-day workshops and group discussions (see Figure 2-40). These charrettes are characterized by continuous coordination and feedback among all parties involved.[41]

Such a process ensures genuine public participation throughout, helps mediate conflicting interests, and strengthens residents' sense of community identity.

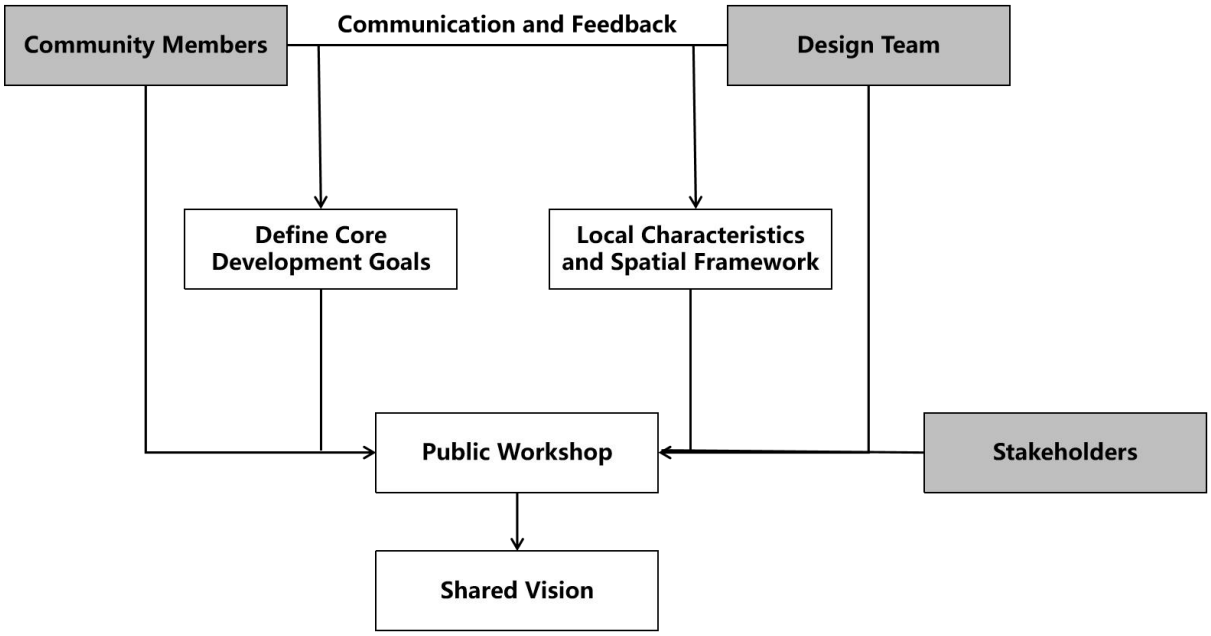


Figure2- 40 Mechanism for Generating Design Vision in Form-Based Codes
(Source: Reference[41])

2.5 Attempts at Urban Form Regulation in the Chinese Context

2.5.1 Compatible Land-Use Planning in Historic Districts

In historic districts with complex existing built conditions, planning efforts go beyond the conventional content typically required in conservation plans—such as land-use maps,

building height control maps, and transportation plans. For instance, in the Baohua Road Historic and Cultural District, a compatible land-use plan was introduced. This plan delineates areas where commercial and public service buildings are allowed, where only public service buildings are permitted, and where no compatibility is permitted. However, in incremental development scenarios, land-use compatibility is often treated as a design strategy to guide spatial development, rather than being enforced through binding regulatory diagrams.



Figure2- 41 Classification Map of Functional Compatibility in Buildings
(Source: Conservation Plan for the Baohua Road Historic and Cultural District, Guangzhou)

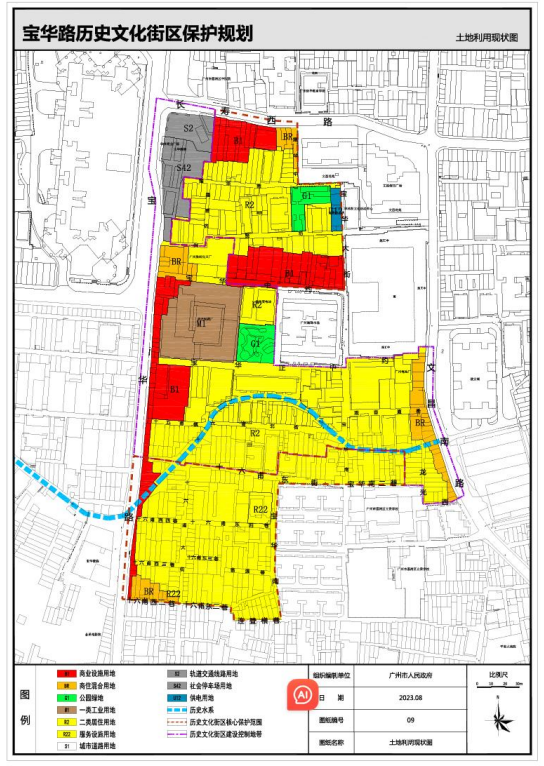


Figure2- 42 Existing Land-Use Map in the Baohua Road Conservation Plan
(Source: Conservation Plan for the Baohua Road Historic and Cultural District, Guangzhou)

2.5.2 Density Zoning at the Urban Scale

In the Shenzhen Urban Planning Standards and Guidelines, a land-use density zoning system has been established to ensure both efficiency in productive spaces and comfort in living environments. This system defines different Floor Area Ratio (FAR)ranges for residential, commercial, and industrial land within various density zones, thereby controlling urban form at the metropolitan scale.

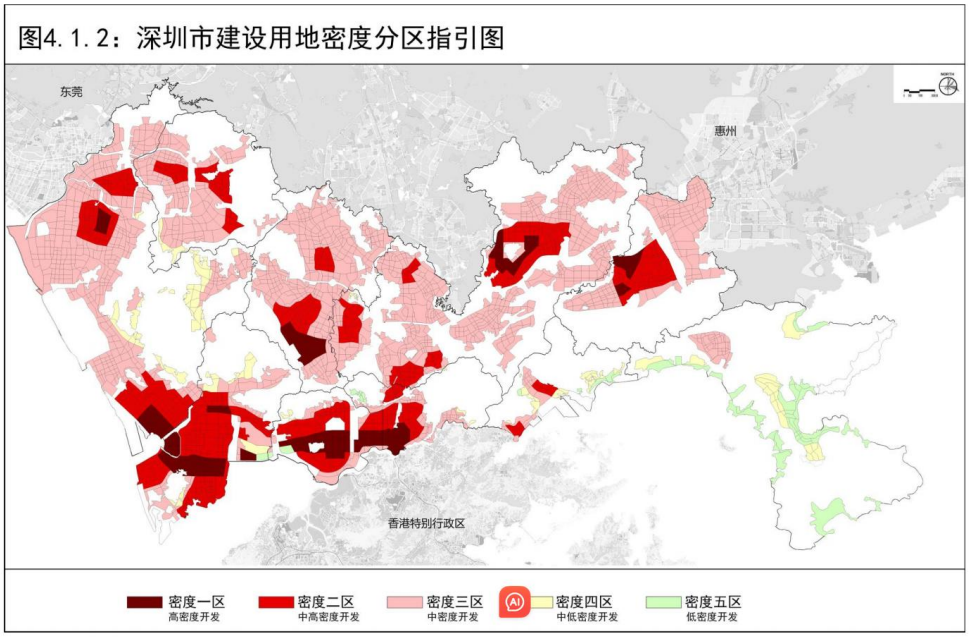


Figure2- 43 Density Zoning Guidance Map for Construction Land in Shenzhen
(Source: Shenzhen Urban Planning Standards and Guidelines)

2.5.3 Supplementary Means for Form Control — Additional Codes

Some awareness has emerged regarding the limitations of the current system in effectively controlling urban form, leading to attempts to address these shortcomings. For example, the Additional Codes section of *the Shanghai Regulatory Detailed Planning Code (Trial Version 2020)*, shown in Figure 2-43, enhances control over form elements by removing rarely used elements with low relevance to public spaces—such as road curbstone lines—and adding elements like "building height break lines and corresponding heights" and "important interfaces." [55]

Various municipal planning departments have launched multiple attempts to incorporate form element control within the statutory planning framework. However, these attempts are essentially compensatory measures grounded in a function-oriented approach. The practical implementation path for form control within the statutory planning system still requires further exploration.

2.6 Summary of The Chapter

This chapter reviews the theory and evolution of Form-Based Codes (FBCs), highlighting their core principles, key components, and advantages over traditional zoning. Originating from critiques of post-war U.S. urban sprawl and zoning's neglect of form, FBCs—pioneered by the Seaside Code (1982), enriched by Transect theory and SmartCode—have become a standardized planning tool shifting focus from land use to spatial form.

FBCs regulate the built environment through regulating plans, building standards, and public space standards, emphasizing typology, multi-scalar design, and the quality of public space to create walkable, mixed-use, and vibrant urban settings.

Compared with China's current regulatory system, FBCs offer broader applicability to complex urban renewal, more precise spatial guidance, stronger enforceability, and deeper public participation. For Yuangang, a fragmented peri-urban area undergoing industrial and spatial transformation, FBCs provide valuable strategies for enhancing spatial quality and achieving integrated urban development.

Chapter 3: Case Studies on the Implementation of Form-Based Codes

3.1 Multi-Scale Urban Coverage

According to the case studies presented on the website of the Form-Based Codes Institute (FBCI), form-based codes can be applied to a wide range of physical environments, including cities, suburbs, rural areas, counties, and special settings such as islands.

Based on the standards set by the FBCI, a major city is defined as having a population of over 500,000; a large city between 100,000 and 500,000; a medium-sized city between 20,000 and 100,000; and a small city as having fewer than 20,000 residents. However, the target areas for the formulation of form-based codes do not always align with statistical population classifications. In many cases, codes are developed for key development zones or central urban areas.

This section will analyze cases at three different scales—large city, medium and small city, and urban block—to further understand the application methods and key focuses of form-based codes across various urban scales.

3.1.1 Large City Scale: The "Miami 21" Form-Based Code

The City of Miami, with a population of approximately 390,000, faces challenges stemming from rapid economic growth and urban development. The existing Zoning Code was unable to effectively address conflicts between newly constructed towers and single-family neighborhoods, resulting in a lack of coherence in urban development. In response, the City of Miami chose to adopt the SmartCode to replace the existing Zoning Code and formulated the Miami 21 Code. The code began by using urban corridors as the basis for zoning, initially covering areas within a quarter-mile radius, and was later expanded to the entire city.

The primary goal of the code is to balance high-density development with single-family neighborhoods: within the limits of existing density standards, it seeks to ensure appropriate transitions between areas designated for upcoming high-density development and single-family residential communities, while also reinforcing the local character of existing neighborhoods. To achieve this goal, the code introduced several innovations:

(1) **Creation of a sub-zone system based on T-zones:** Each T-zone is broken down into subsets. The code defines seven transect zone types, totaling 17 zoning types, to ensure a smooth transition from high-density, high-intensity development areas to low-density residential neighborhoods.

(2)Reduction of use categories and simplification of use regulations: The number of land use categories was reduced from 360 to 46.

(3)Establishment of an innovative metric system: Floor Area Ratio (FAR)was replaced by Floor Lot Ratio (FLR), which is calculated using Net Lot Area (NLA)and Gross Floor Area (GFA).

The Miami 21 Code represents the first successful application of the SmartCode in a large city. Through transect-based planning, public benefit strategies, and architectural form standards, it has advanced sustainable development in Miami. The Miami 21 Code offers a replicable model for other large cities and demonstrates the broad applicability of form-based codes in urban planning.

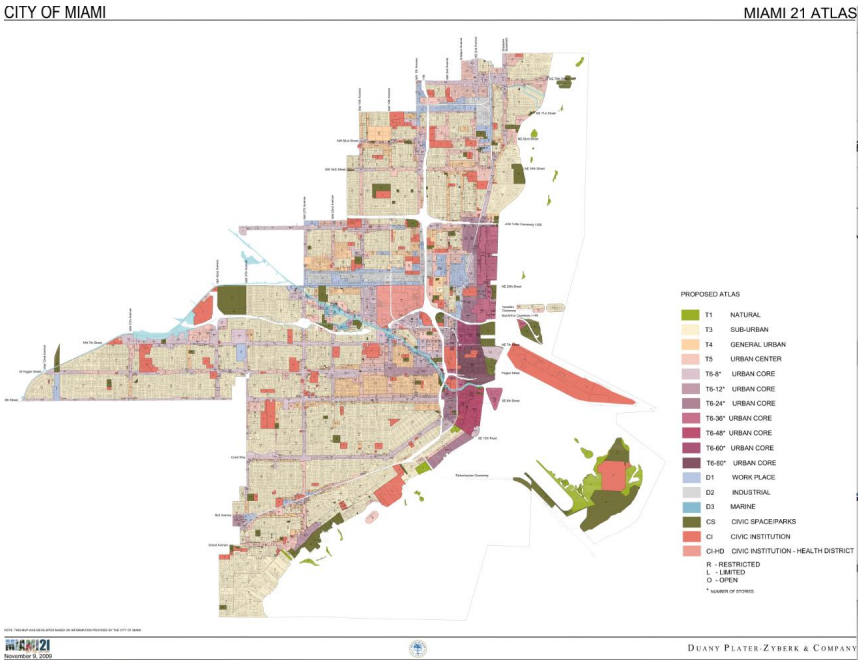


Figure3- 1 Miami 21 Regulating Plan

(Source：https://formbasedcodes.org/codes/miami-21/)

3.1.2 Medium and Small City Scale: City of Santa Ana Form-Based Code

Compared to form-based codes that cover entire cities or counties, those formulated for specific districts or neighborhoods are the most common and widely used type. These often

target areas such as downtowns, key development zones, single or multiple neighborhoods, urban renewal districts, or undeveloped land.

The City of Santa Ana is the most populous city in Orange County, with a population of approximately 340,000. While it qualifies as a large city by population, the form-based code project focused on a 181-hectare urban core area, covering three blighted districts and three streets. Since the code was not designed for the entire city, it is categorized as being at the urban core scale. Compared with large cities, which tend to emphasize overall structural control, Santa Ana places greater focus on the spatial form of building layouts and streetscapes. Although the code adopts a transect-based organizational principle, it does not follow the typical T-zone naming system. Instead, it uses context-specific names such as Downtown (DT)Zone and Urban Center (UC)Zone, reflecting local characteristics.

(1)The code emphasizes smooth transitions between different zones.

(2)It provides detailed requirements for building types, building layouts, and frontage types in each zone, and establishes a clearly illustrated and easy-to-understand graphic language system.

(3)The code includes comprehensive design considerations for public spaces, with specific regulations on elements such as seating, street lighting, and other streetscape furnishings.

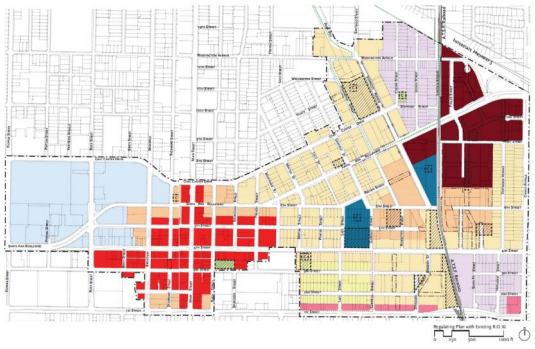


Figure3- 2 Form-Based Regulating Plan in the Santa Ana Renaissance Specific Plan

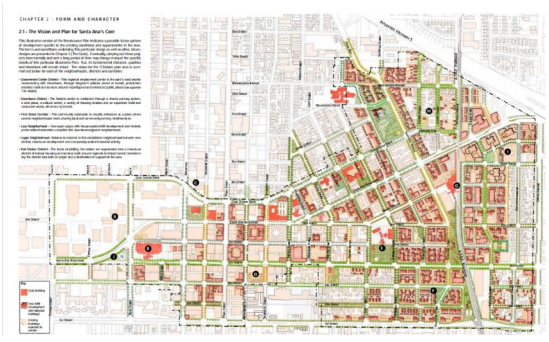


Figure3- 3 Illustrated Plan in the Santa Ana Renaissance Specific Plan

(Source：https://formbasedcodes.org/codes/miami-21/)

3.1.3 Block Scale: Benicia Downtown Mixed Use Master Plan

The City of Benicia is located along the Carquinez Strait in the San Francisco Bay Area, with a population of approximately 2,800. The local government aims to use form-based codes to focus planning efforts on the downtown area, shaping its identity, preserving the form and character of historic districts, and enhancing vibrancy.

This code primarily targets Benicia's downtown area, which covers 35.6 hectares. Its purpose is to implement the mixed-use development vision outlined in the city's master plan for downtown, enhancing functional integration while preserving historical characteristics, thereby sustaining vibrancy and maintaining land value.

(1)Establishing a hierarchical transect zoning system: The plan adopts transect zones from T3 to T5, forming a gradient structure of "Town Core (TC) – Town Core Open (TC-O) – Neighborhood Center (NC) – Neighborhood General (NG)."

(2)Emphasizing transitional spatial structure: The plan ensures a gradual transition from the vertically oriented, historically styled commercial street area to the residential neighborhood clusters on the east and west sides. The east – west streets are designated as transitional zones, with controlled regulations on building form and use within these zones.

(3)Establishing a two-dimensional mixed-use model: Different zones emphasize distinct approaches to functional mixing. The TC zone focuses on vertical mixed use along the main street (ground-floor commercial with upper-floor residential), while the NG zone protects residential character. The plan also introduces innovative "open" transitional zones (such as TC-O and NG-O), allowing commercial and residential uses within a single building. These zones emphasize use compatibility to adapt to market changes.

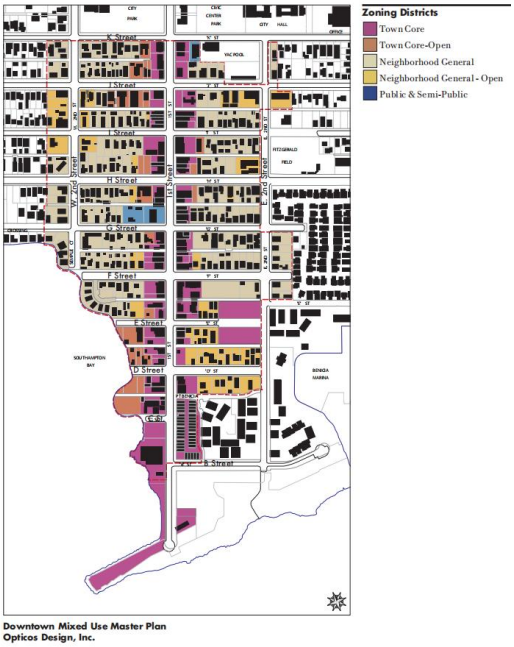


Figure3- 4 Benicia Form-Based Regulating Plan

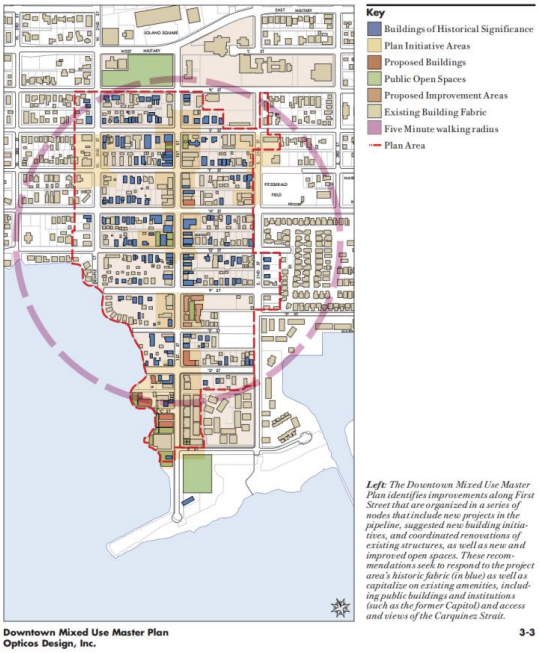


Figure3- 5 Benicia Form-Based Illustrated Plan

(Source:Benicia Downtown Mixed Use Master Plan)

3.2 Expansion of Applications Across Project Types

Form-based codes are applicable to a wide range of development types. This section selects five categories—brownfield redevelopment, infill development, historic preservation, regional coordination, and comprehensive revitalization—each illustrated by a representative case.

3.2.1Brownfield Redevelopment: The Commons Design Standards and Guidelines, City of Denver

Denver is the capital and largest city of the state of Colorado. The Commons Design Standards and Guidelines in Denver provide a representative form-based framework for the redevelopment and reuse of urban brownfields. The Central Platte Valley, once home to railyards, industrial zones, and warehouse facilities known as "The Bottoms," had long functioned as Denver's industrial "back door" and was marked by environmental degradation and functional decline.

The core objective of the code was to transform this deteriorated industrial area into a multifunctional urban neighborhood through brownfield redevelopment—restoring ecological

systems, revitalizing the economy, and reconnecting downtown with surrounding areas such as Lower Downtown. By integrating ecological restoration, mixed-use development, continuity of historical context, and refined design standards, the project sought to convert industrial wasteland into a sustainable "urban village," offering a systematic solution for high-density urban renewal. The experience emphasizes multi-stakeholder collaboration, pedestrian-first design, and flexible regulation, offering valuable insights for other industrial brownfield projects.

The plan converted abandoned railway lands into a mixed-use community composed of six subareas, introducing functions such as office spaces and tech parks to attract investment, support regional rail transit, and—through a flexible design framework—reconcile historical preservation with modern functional needs while providing diverse housing options.

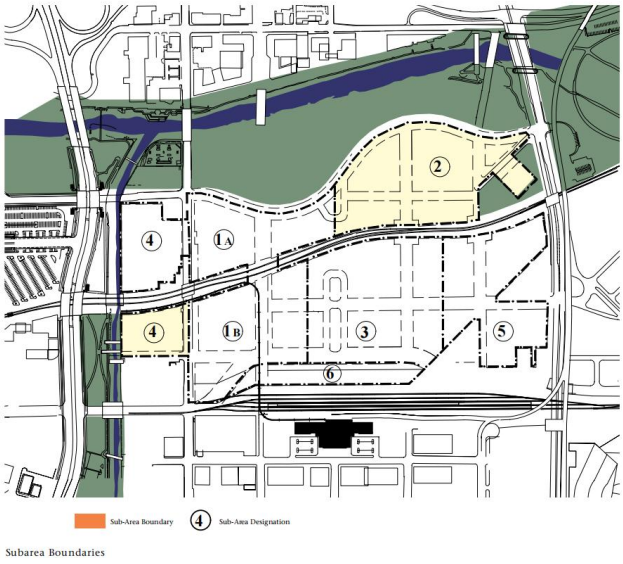


Figure3- 6 Subarea Boundary Map of The Commons Design Standards and Guidelines, Denver

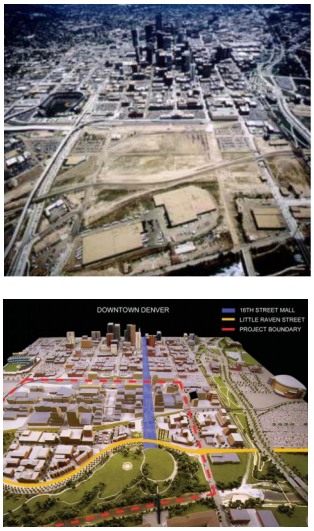


Figure3- 7 Comparison of Existing Conditions and Design Models in The Commons Design Standards, Denver

(Source:The Commons Design Standards and Guidelines)

The planning strategies focus on the following key areas:

(1)Environmental Remediation and Ecological Protection: Integrated old railway lines, removed outdated overpasses, and established Commons Park as a central open space. Restoration efforts targeted the riverbanks of the South Platte River and Cherry Creek, creating a linear green-way.

(2)Mixed-Use Development and Functional Activation: Developed a community with

residential, office, hotel, retail, and cultural facilities. "Pedestrian Active Use" regulations ensured ground-floor commercial spaces engaged directly with the public realm. Transit-oriented development was prioritized to reduce reliance on private vehicles.

(3)Building Form Regulation: Enforced "Build-To Line" requirements to ensure buildings align with the street edge, forming a continuous urban frontage. Historic landmarks like Denver Union Terminal were preserved, while new construction was required to reflect traditional materials (such as brick and cast iron)and appropriate scale.

3.2.2 Infill Development: Downtown Montgomery Plan

Montgomery, located in central Alabama, is the state capital and the second-largest city, with a population of approximately 200,000 in 2006. As both the state capital and a regional economic center, its downtown area exhibited signs of "hollowing out." The plan applied form-based code principles organized by transects, with a focus on restoring the value of historic buildings and streets, creating a walkable street network, and optimizing public urban space.

Using transect-based structuring, the plan prioritized improvements to the transportation system and street space, offering projections for urban spatial form under traditional zoning and form-based code control (see Figure 3-9、3-10).

Key strategies include:

(1)Repairing and Infilling the Urban Fabric: Development was targeted at vacant lots, surface parking, or abandoned sites to restore the continuity of the urban fabric and reduce land waste.

(2)Mixed and Diverse Uses: The plan encouraged a mix of land uses, building types, and housing options—such as vertical or horizontal combinations of commercial, residential, and office uses—to enhance downtown vibrancy and convenience.

(3)Historic Preservation and Adaptive Reuse: Historic buildings were protected and rehabilitated for contemporary use—such as converting warehouses into apartments or historic buildings into commercial spaces—while ensuring that new development aligns with the scale and style of the historic district.

A representative spatial intervention was the revitalization of Dexter Avenue. Once the

city's economic hub, the avenue had declined alongside downtown depopulation. Infill development reactivated commercial and residential functions along this main corridor, increasing street-facing retail, office, and residential units. Design strategies included rebuilding along street frontages, inner-block infill, street tree planting to enhance streetscape, and a comprehensive redesign of the courthouse square at the avenue's terminus.

Montgomery’s application of SmartCode demonstrates how flexible, adaptive planning tools can address urban sprawl and functional segregation. Through the gradual adoption of both optional and mandatory SmartCode elements, the city successfully advanced New Urbanist projects and offered valuable guidance for other cities.

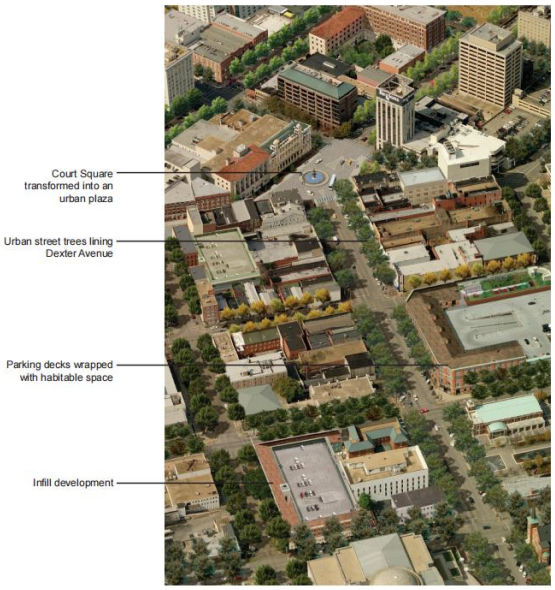


Figure3- 8 Dexter Avenue Redevelopment Rendering



Figure3- 9 Regulating Plan of Montgomery

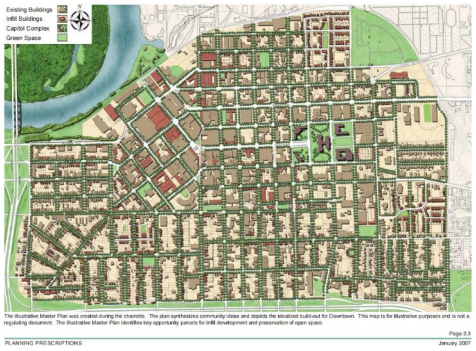


Figure3- 10 Illustrative Plan of Montgomery

(Source:Downtown Montgomery Plan)

3.2.3 Historic Preservation Development: Ventura Downtown Specific Plan

The *Ventura Downtown Specific Plan* in California was the first to adopt a form-based code in the city center in 2007, later extended citywide. Ventura is located on the southern Pacific coast of California, with a population of about 100,000. The code aimed to preserve Ventura’s sense of place, ensure compatibility between new construction and the city’s historic and eclectic architectural context, activate public spaces, provide housing for diverse

income groups, and build a walkable downtown.

The plan adopted a transect-based code structure, with each zone emphasizing mixed functions and architectural diversity. For example, commercial uses were permitted in T4 to T6 zones, encouraging a range of building forms and mixed-use typologies.

Ventura contains a rich collection of historic districts, buildings, and archaeological resources. A multi-layered preservation strategy ensures these resources remain a lasting source of urban vitality.

(1)Designating Preservation-Based Development Areas: The Selwyn Shaw and Mitchell Block Historic Districts were demarcated for controlled development. Demolition or encroachment upon historic buildings was prohibited; projects that preserved or restored historical landmarks were prioritized. New construction was required to respect historic character (e.g., in proportion, materials, and color), minimizing negative impacts on heritage assets.

(2)Establishing a Flexible Framework for Historic Building and Landmark Preservation: The code supported the preservation of multiple architectural styles—such as Victorian and Spanish Revival—by promoting compatibility in massing and color schemes. While specific styles were not mandated for new buildings, a principle of "incremental renewal" was encouraged to balance respect for historical texture with modern functional demands.

(3)Protecting Widely Distributed Archaeological Resources: The Chumash settlement of Shisholop, dating back to around 1000 CE and once a provincial capital, now lies beneath the end of Figueroa Street as a buried archaeological site. In cases where such sites are discovered during development, "avoidance and protection" or "data recovery" strategies were adopted. Projects were required to reconcile surface construction needs with the preservation of underground heritage resources.

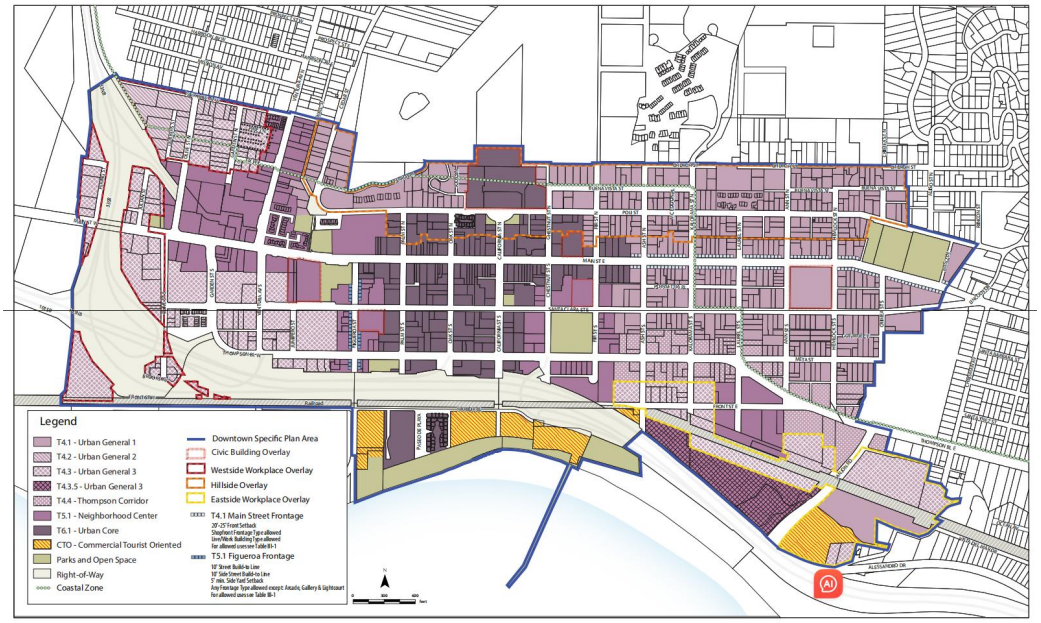


Figure3- 11 Regulating Plan of Ventura

(Source:Ventura Downtown Specific Plan)

3.2.4 Regional Coordinated Development: Roosevelt Road Form-based Code

The *Roosevelt Road Form-based Code* was the result of a collaborative effort among the cities of Oak Park, Berwyn, and Cicero in the Chicago metropolitan area. The code was applied along a 2.4 km corridor of Roosevelt Road. It delineates three functional zones: Pedestrian-Oriented District (RR-P), Auto-Oriented District (RR-A), and Transition District, with the goal of promoting a pedestrian-focused development model.

In the Pedestrian-Oriented District (RR-P), priority is given to pedestrian comfort and safety. In the Auto-Oriented District (RR-A), the code balances vehicular circulation and building form, providing parking for shopping and mobility needs while supporting corridor businesses with ample parking supply. The Transition District accommodates both pedestrian and vehicular demands, allowing partial building setbacks with optimized parking layouts.

Key regional coordination strategies include:

(1)Establishing a Cross-Jurisdictional Form-Based Zoning Coordination System: Spanning three municipalities, the corridor is functionally divided into pedestrian, transition, and auto zones. Mixed-use buildings (e.g., retail + residential)are encouraged, while single-use industrial development is restricted to avoid fragmented growth.

(2)Creating Unified Goals and Planning Standards Across Jurisdictions: The code is implemented consistently across all three municipalities, ensuring uniformity in Roosevelt Road's streetscape and zoning rules. The collaboration addresses issues such as traffic congestion and economic decline, aiming to enhance the region’s commercial appeal and tax base.

The code regulates aspects such as building layout, height, parking design, and street frontage along the corridor. It strengthens physical design control through form-based regulation, de-emphasizes traditional land-use zoning, and prioritizes interaction between buildings and public spaces. The project represents an eight-year cooperative process among local governments and residents, achieving integrated regional development through inter-jurisdictional coordination.

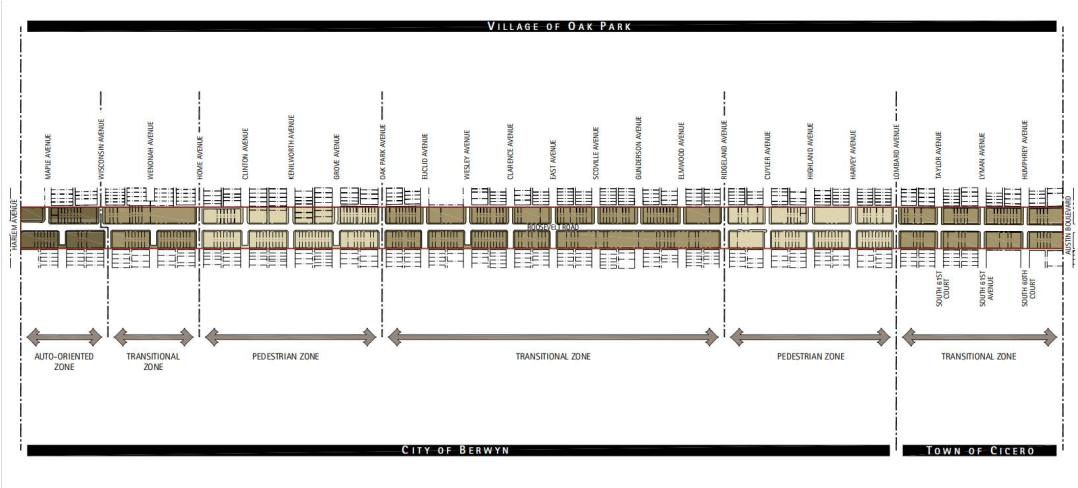


Figure3- 12 Regulating Plan of Roosevelt Road[50]

(Source:Roosevelt Road Form-based Code)

3.2.5 Comprehensive Enhancement Development: Cincinnati Form-Based Code

Many cities take into account their specific urban characteristics when formulating form-based codes (FBC), with the goal of achieving comprehensive urban enhancement. Among them, the City of Cincinnati serves as a representative example. Through form-based codes, Cincinnati aims to promote a walkable, mixed-use, and sustainable pattern of re-urbanization, balancing historic preservation with modern demands, reducing dependence on automobiles, and enhancing community vitality.

The city adopts a gradual, incremental approach, allowing each neighborhood to customize its own form-based code according to its unique conditions. This method enables the FBC to organically "grow" across the entire city over time. It also encourages community-based planning, high-quality urban infill, and the improvement and enhancement of existing buildings and neighborhood structures. For cities seeking to shift toward form-based regulation, this process represents a new and adaptable model.

(1)Continuous Transect Zoning: Based on the transect model, the city is divided into a continuous transition from T3 to T6 zones. Each transect allows for sub-zones that extend use compatibility and support gradual, incremental development.

(2)Establishing a Rich Set of Building Type Standards: The code defines over 20 building types to accommodate various density and use combinations. It also sets standards for frontage types, walkable blocks, and streets. Additional provisions address sloped neighborhoods, historic districts, parking areas, and corner retail buildings.

(3)Establishing Walkable Neighborhood Standards Across Transects: Standards are established for transect zones, pedestrian shelters, community centers, street connectivity, open space, and public space allocation.

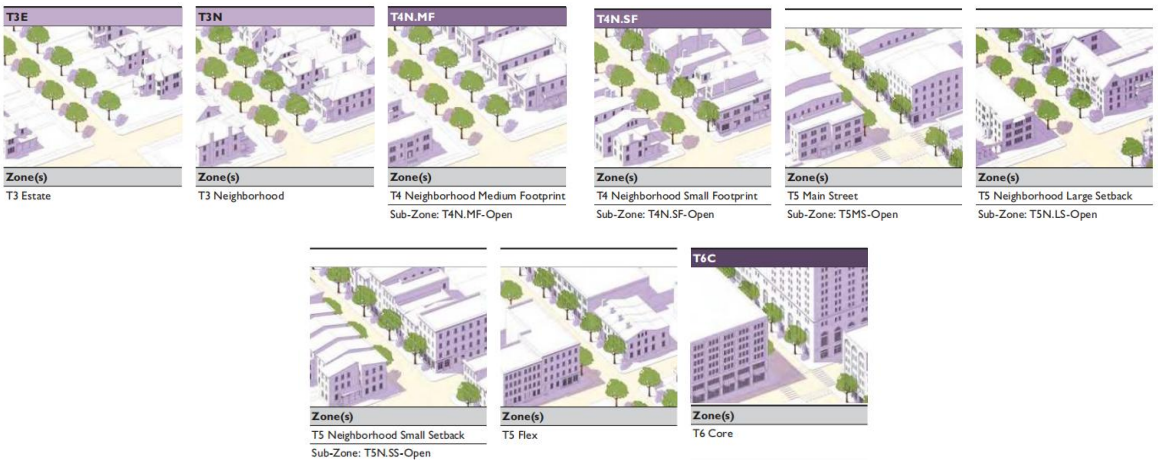


Figure3- 13 Illustration of Cincinnati Transect Zoning

(Source:Cincinnati Form-Based Code)

3.3 Flexible Application of Multiple Principles

The transect-based code is the most widely applied principle in form-based code (FBC)practice. Many of the cases discussed above adopt the transect as the primary

organizing principle for their form-based codes and will not be repeated here. As FBCs have become more widely implemented, other organizing principles — such as building frontage type, building typology, and street hierarchy — have gradually been utilized in actual development practices.

3.3.1 Building Frontage Type Code: Peoria Downtown Land Development Code, Illinois

The City of Peoria, located along the Illinois River, has a population of approximately 113,000. The city sought to revitalize its downtown area—particularly its historic commercial and residential districts—through the use of form-based codes. The goal was to create a more walkable, mixed-use urban environment, enhancing both quality of life and economic vitality. Through detailed urban design and form-based regulations, Peoria aimed to transform its downtown core into a more cohesive and livable area.

The code is organized around building frontage typologies, **with a particular focus on revitalizing pedestrian-oriented commercial street frontages**. It defines four distinct form districts: Sheridan Triangle, Prospect Road, West Main Form District, and the Warehouse District. Each district includes specific design standards and use regulations for both street spaces and building frontages.

The principal strategies are as follows:

(1)Revitalizing Historic Buildings in the Warehouse District: Abandoned industrial buildings are converted into mixed-use communities, retaining historic features such as brick facades and high ceilings, while introducing office and retail functions to restore the heritage value of the area.

(2)Stitching Together a Walkable Network: By revitalizing community commercial centers such as the Sheridan Triangle and rebuilding pedestrian-prioritized street frontages (e.g., narrowing vehicular lanes, widening sidewalks), the plan counters the commercial hollowing caused by suburbanization.

The code further exercises control over street form by defining building plots and plot boundaries, with a notable emphasis on managing corner conditions. It employs a combination of text and visual illustrations to ensure clarity and ease of use.

3.3.2 Building Typology Code：Birmingham Triangle Overlay District

Many early form-based codes, particularly those developed for private projects, were organized around building typologies. This type of code is especially effective in small communities—under 1 square kilometer or composed of two to three neighborhoods—where there are minimal form differences. Using building types as an organizing principle allows for detailed control at the building scale, clearly defining physical form and basic use. This approach enables each subdivided plot to be authorized through pre-defined building types, helping to preserve and reinforce community character. By promoting a diverse mix of building types, it also facilitates positive neighborhood development and avoids monotonous, repetitive typologies.

The Triangle Overlay District in the City of Birmingham is a form-based code organized around building typologies. Its aim is to encourage compact, mixed-use development (including commercial, residential, and office functions), reduce traffic congestion, eliminate inefficient surface parking, minimize environmental impact, ensure smooth transitions to adjacent residential areas, support innovative building design, and establish a distinct neighborhood identity.



The code establishes four form-based regulatory districts. Based on building form, height, and use, the code delineates one area for attached single-family housing (ASF-3)and three mixed-use zones (MU-3, MU-5, MU-7).

It specifies detailed spatial requirements for each district, including building footprint, height, transparency rate, and setback conditions. Dedicated chapters address standards for building height and placement, architectural detailing, and streetscape design, offering clear expectations for spatial outcomes.

Figure3- 14 Regulating Plan for the Triangle Overlay District
(Source:Birmingham Triangle Overlay District)

3.3.3 Street Hierarchy-Based Regulating Code:Regulating Code for the Central Hercules Plan

Hercules is located on San Pablo Bay, 16 miles east of San Francisco. Originally a company town for the Hercules Powder Company, it was once a prosperous industrial city. Since the early 2000s, the city began facing challenges such as environmental degradation, rising housing costs, and declining tax revenue.

This regulating code adopts street type as its organizing principle. Its main goal is to restore local character and enhance revenue-generating potential by building a walkable, mixed-use community and improving connectivity across different areas.

The code innovatively establishes a hierarchical street system: by defining a clear typology of nine street types (including four-lane boulevards, two-lane boulevards, main streets, center streets, and neighborhood streets), it ensures an integrated relationship between buildings and streets and promotes a unified block identity through comprehensive planning.

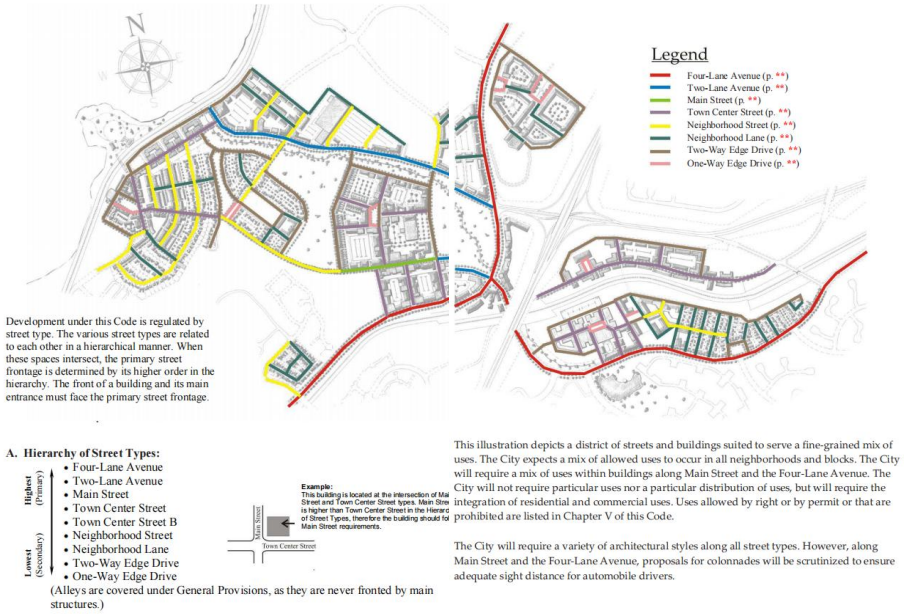


Figure3- 15 Regulating Plan for Hercules

(Source:Street Hierarchy-Based Regulating Code)

3.4 Summary of The Chapter

This chapter analyzes representative international cases to demonstrate the broad applicability and adaptability of Form-Based Codes (FBCs) across scales, project types, and organizational principles, providing theoretical support and practical references for Yuangang’s urban design.

FBCs can operate from citywide plans (e.g., Miami 21) to downtown districts (e.g., Santa Ana) and neighborhood plans (e.g., Benicia), using the Transect to coordinate transitions between high- and low-density areas while ensuring design goals are carried through different levels. They have been applied to diverse projects, including brownfield redevelopment (Denver), infill (Montgomery), historic preservation (Ventura), corridor revitalization (Roosevelt Road), and comprehensive upgrades (Cincinnati), proving effective in addressing mixed-use, heritage, ecological, and industrial-transition challenges.

Beyond the Transect, flexible organizing principles—such as frontage types (Peoria), building types (Birmingham), and street hierarchy (Hercules)—enable place-specific customization.

In sum, FBCs are not rigid regulations but flexible methods that prioritize spatial form over land use to create livable, sustainable, and vibrant environments. These global experiences offer valuable lessons for applying FBCs to Yuangang, a fragmented peri-urban area undergoing transformation.

Chapter 4: Analysis of Form Characteristics and the Application of Form-Based Codes in Yuangang Area

4.1 Application Methods of Form Guidelines in the Yuangang Area

Although the Form guidelines originated in the United States and were shaped by its urban planning context, they have universal value in shaping urban spatial forms and can be adapted to various regional settings, including the Yuangang area.

4.1.1 Grasping Spatial Elements at All Scales: District, Block, and Building

The form guidelines align with the principles of New Urbanism, which generally emphasize comprehensive spatial control across three key scales: city, block, and building. The application of these principles in practice focuses on managing space from a broad urban perspective to a micro-scale architectural design.

(1)Urban Scale

The first step is to understand the overall spatial distribution and layout of the city. This involves the creation of different types of cross-sectional zones, considering factors such as building height and development intensity. These aspects help shape an urban landscape that aligns with the desired vision for each specific zone.

(2)Block Scale

This scale is more focused on detailed elements such as street landscapes, urban interfaces, and open spaces. The goal is to create blocks that are pedestrian-friendly, with appropriate scales for public and private spaces. Streets should be designed to enhance walkability and connectivity, facilitating the flow of people while maintaining an attractive and functional environment.

(3)Building Scale

This involves the classification of building types and setting up guidelines for building setbacks, heights, and related ancillary facilities. These standards help create a coherent architectural language that fits within the larger urban context. At this scale, the guidelines ensure that buildings complement each other and contribute to the desired character of the area.

In practice, the approach often starts from the larger city or district level, with a focus on

macro- or meso-scale elements. By applying these three interconnected spatial scales, it ensures a holistic approach to urban design—from the overall district planning to the fine details of building design.

4.1.2 Urban-Level Form Elements: Neighborhoods, Corridors, and Districts

As mentioned earlier, the practical application of form guidelines incorporates key urban elements such as neighborhoods, districts, and corridors, which are central to the concept of New Urbanism.[39] These elements help define the structure of urban development and redevelopment.

(1)Neighborhoods

A neighborhood is typically defined by a 5-minute walking radius, forming a core living area with various commercial and service facilities. This concept is commonly applied in Chinese urban planning, where residential areas are developed around such neighborhood cores. These "5-minute, 10-minute, and 15-minute circles" are designed to create convenient access to amenities and services for residents, thereby reducing the reliance on cars.

(2)Districts

In the context of form guidelines, districts are areas designated for specific purposes or land uses. However, in this design, the emphasis is placed on form-based zoning, where the focus is on shaping distinct spatial zones based on their physical characteristics, rather than merely defining functions. These districts are visually and spatially distinct, with clear boundaries that differentiate them from other areas.

(3)Corridors

A corridor in this context does not merely refer to vehicular transportation routes but also includes pedestrian paths and links between neighborhoods and districts. These corridors define the physical boundaries between different areas, facilitating movement and connections within the city. Corridors also serve as important interfaces, integrating the flow of people and traffic within the urban fabric.

In this practice, the concept of spatial elements from the form guidelines is adopted instead of traditional functional zoning. The aim is to form a spatial design framework based

on neighborhoods, districts, and corridors. This framework creates a seamless integration of spaces that are functionally and aesthetically connected, fostering an environment that supports both community interaction and urban vitality.

By leveraging these three spatial elements, the Yuangang area can evolve into a well-connected, human-scaled urban environment that facilitates mobility, interaction, and a high quality of life for its residents. The application of these principles allows for flexible land use while ensuring that the area's spatial organization remains cohesive and harmonious.

4.2 Site Status Study

The study site is located in the Yuangang area, situated north of the Tianhe Passenger Station. The area is defined by the following boundaries:ZhongcCross RoadI(North),Shatai North Road and Shahe Stream(West),Tianyuan Road(East), Guangzhou Ring Expressway(South).

According to the *Guangzhou Government Work Report* for the end of 2024, there is a major push to leverage the Wushan Research and Higher Education platform to establish an "Innovation Hub" around the Wushan area. The initiative aims to facilitate the transformation and upgrading of industries, while also advancing the renovation of urban villages. This plan will likely have significant implications for the future development and urbanization of the Yuangang area, driving both industrial and residential growth.

The existing landscape of the area is a mix of industrial, residential, and public service spaces. In terms of infrastructure, the area benefits from its proximity to major roads like ZhongcCross Road, Shatai North Road, and Tianyuan Road, which provide crucial connectivity to the wider city and surrounding regions. However, the region is also characterized by underutilized industrial spaces, outdated urban villages, and a complex mix of land uses, which present both challenges and opportunities for redevelopment.

The area's strategic location and government-backed transformation plan make it a key site for urban renewal, with a focus on fostering innovation, upgrading the local economy, and improving the living environment for residents. As part of this transformation, it is important to address the existing infrastructure gaps, enhance connectivity, and create a cohesive urban fabric that supports both residential and industrial needs.

With these objectives in mind, the design and planning of the Yuangang area will need to focus on integrating modern urban principles, including mixed-use development, enhanced transportation networks, and environmental sustainability, while respecting the historical and socio-economic context of the site.



figure4- 1 Yuangang Area Macro Location Map

(Source: drawn by the author)

4.2.1 Development History of the Yuangang Area

The Yuangang area, located in the Tianhe District of Guangzhou, has a rich and layered history that reflects the broader evolution of the city. The area was initially formed as a village during the Southern Song Dynasty. In the early years of the Republic of China (1912), the region was part of Panyu County and under the jurisdiction of Lubu Bureau. The area is located at the intersection of Tianhe District and Baiyun District, with Shahe Stream serving as the boundary.

After the founding of the People's Republic of China, the administrative boundaries and jurisdictions of the area underwent several changes. In 1999, Yuangang Subdistrict Office was established, followed by the creation of Jingxi Subdistrict Office in 2001. As Guangzhou prepared for the 6th National Sports Games (Liuyunhui)and the development of Zhujiang New Town, urban construction in the city began to radiate towards Tianhe District, marking the beginning of more structured urbanization in the area.

(1)Post-Reform and Opening Up:1978-1998

Following the Reform and Opening Up period, Guangzhou entered a phase of rapid urban expansion. Between 1978 and 1998, the city experienced significant urban sprawl. Previously isolated areas on the outskirts of the city gradually merged with the central urban district. At the same time, new "leapfrog" development zones appeared on the periphery.[13]In 1983, the Yuangang area was primarily made up of farmland and small villages. Two villages, Yuangang and Changban, were situated here, and several universities, including South China University of Technology, had already established campuses. Sha Tai North Road was built, but much of the area remained agricultural, with lush vegetation along the Shahe Stream.

(2)Rapid Development:2000-2010

From 2000 to 2010, the Yuangang area underwent rapid urban development. Farmlands were increasingly converted for construction purposes, with the establishment of markets such as the Gu Yu Market and Utopia, which took up large portions of the formerly vacant land. A significant number of factories and markets were built, which formed the basis for the area's current spatial configuration.

(3)Recent Development:2010-Present

Since 2010, the Yuangang area has continued its construction and urbanization. New roads such as Yuangang Cross Road were completed, and Tianhe New World shopping mall was established. At the same time, older buildings such as the Tianhe Auto Parts City were demolished, and new small-scale industrial parks gradually replaced older factories.

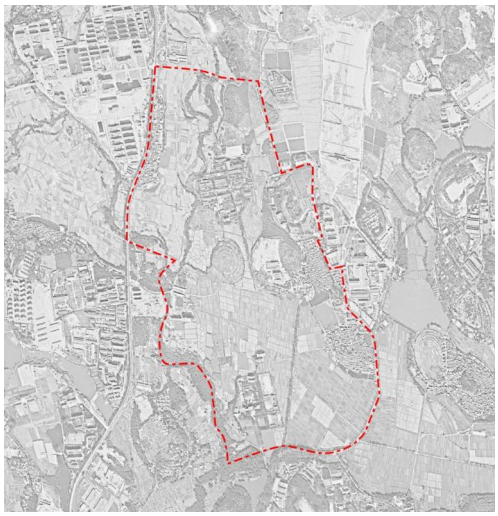
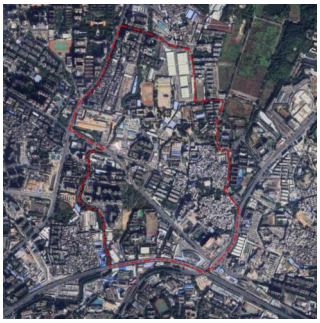
The Yuangang area is now located in the suburban part of Guangzhou. The urban sprawl and the expansion of built-up areas have resulted in a situation where former villages and city districts have become increasingly interconnected. This has led to the coexistence of three different urban typologies: closed vocational colleges, urban villages, and factories, along with other built environments. Additionally, the area lies at the intersection of the Yuangang and Jingxi administrative districts, resulting in a hybrid spatial pattern that is both connected and fragmented. The urban fabric is chaotic, and the spatial elements are complex.

Due to the market-driven land transfer mechanism, the area has begun the process of industrial upgrading and self-renewal. However, the presence of land ownership constraints has meant that urban renewal in Yuangang has primarily involved the demolition and

reconstruction of buildings, rather than being guided by an overarching urban planning framework that fosters orderly development and renewal.

In conclusion, the development of Yuangang has been marked by rapid urbanization, a mix of industrial and residential uses, and a shift from farmland to urban space. The area's complex spatial structure requires careful planning to guide its transformation and integration into the broader urban context of Guangzhou.

Table4- 1 Yuangang District Historical Satellite Images(Source: drawn by the author)

1983	2000	
		
2010	2014	2024
		

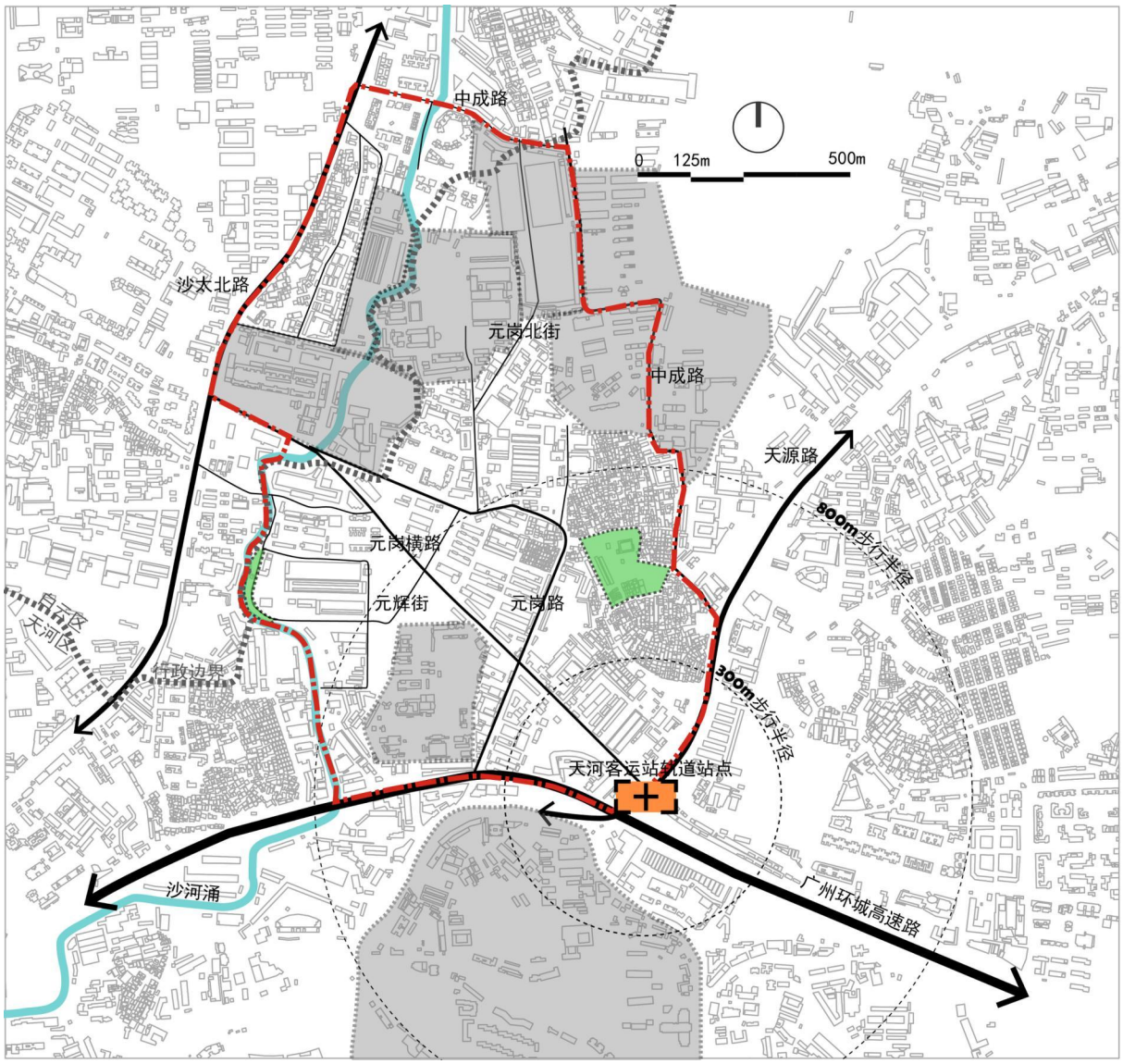


Figure4- 2 Yuangang Area Site Layout Map

(Source: drawn by the author)

4.2.2 Site Analysis of Yuangang Area

The site under study is located at the administrative boundary between Tianhe District and Baiyun District, with Shahe Stream running through it. The area is strategically positioned as a key transportation hub, with Tianhe Passenger Station serving as a major rail transit node that influences almost half of the research area. While the urban village (城中村)benefits from convenient access to the rail transit system, the surrounding infrastructure and road networks pose significant challenges to connectivity.

(1)Impact of Major Roadways and Transportation

The area faces connectivity issues due to the presence of two major roads: the

Guangzhou Ring Expressway (环城高速)and Tianyuan Road (天源路), a rapid transit route. Both roads disrupt the pedestrian network, especially along the eastern and southern borders, severing connections between different areas of the site and the surrounding neighborhoods. These high-speed roads create a barrier for pedestrians and vehicles, limiting access and contributing to the fragmentation of the urban fabric.

(2) Role of Shahe Stream and Industrial Land Use

Shahe Stream, as part of the area's natural water system, is an important element in shaping the site's urban form. However, both banks of the creek are occupied by factory buildings and their auxiliary structures, which are characterized by blank or closed facades that hinder access to the waterfront. Only the southwestern part of the area has seen the implementation of a pocket park, which is a small-scale green space designed to provide some degree of public amenity in the otherwise industrial landscape.

(3) Fragmented Urban Structure

The area exhibits a fragmented and disconnected spatial structure. Several enclosed zones, including vocational colleges, military areas, large factories, and old industrial parks, create isolated pockets within the broader urban context. These isolated zones exacerbate the disconnection between different parts of the site and the larger city. The road network within the area is incomplete and fragmented, with dead-end streets and poorly connected routes contributing to a sense of urban disarray. This lack of connectivity between areas further isolates the spaces, limiting accessibility and reducing the overall vibrancy of the district.

The irregular shape of Shahe Stream, combined with the scattered and disconnected land uses, results in a fragmented urban texture. The existing land uses are stacked in isolated patches, with little to no interaction between different zones. The overall spatial organization lacks cohesion, leading to a disjointed and inefficient urban environment.

(4) Summary

The Yuangang area suffers from several spatial challenges that hinder its connectivity and functionality. The physical barriers imposed by major roads, the fragmented industrial zones, and the lack of cohesive planning all contribute to a disjointed urban fabric. To address these issues, it is crucial to improve the connectivity between different areas, enhance pedestrian accessibility, and integrate open spaces that foster interaction and urban vitality.

The site offers an opportunity for urban renewal, but this will require careful planning to overcome its existing fragmentation and create a more cohesive, accessible, and sustainable urban environment.

4.2.3 Form District Analysis

As the city continues to expand, the Yuangang area in the near suburbs has experienced a transformation from agricultural land to built-up areas. The site now presents a complex and heterogeneous spatial structure, with various urban forms overlapping and interacting. These include enclosed vocational colleges, urban villages (城中村), factories of varying sizes from different time periods, newly developed residential communities, large commercial complexes, and apartment buildings built in the past decade. The built environment is characterized by a mixture of different development types, building densities, scales, and intensities, which are both interconnected and, at times, in conflict with one another.

Considering the diverse building forms, heights, and development intensities, the site has been divided into nine distinct form districts, excluding the military area. These zones are characterized by unique spatial and architectural attributes, which will be summarized below. The analysis will focus on identifying the typical building forms, street interfaces, and main functions of each zone, helping to better understand the site's distinct spatial features from a Form perspective.

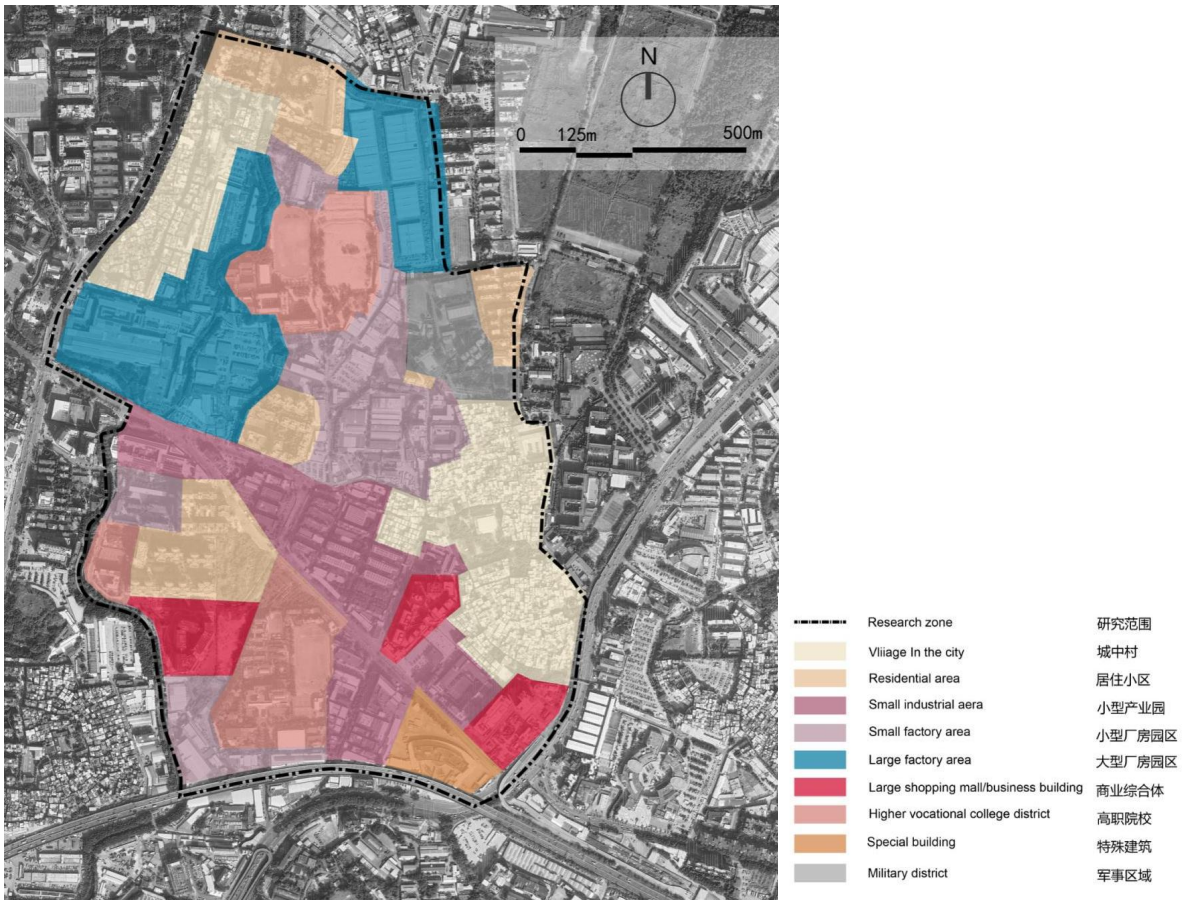


Figure4- 3 Current Form District map

(Source: drawn by the author)

(1)Urban Villages

Urban villages, which were constructed in earlier periods, are a unique settlement form that emerged as rural collective land was surrounded by urban land during the process of urbanization. These settlements are typically composed of "handshake buildings"(Table 4-2 middle)arranged in a clustered form. The buildings are constructed tightly along the boundaries of land parcels, maximizing the use of homesteads or collective land, while public spaces are fragmented and compressed. Public activities primarily take place on streets or within individual building units. The floor area ratio (FAR)exceeds 3.0, and the internal building spacing is less than 1.5 meters, creating a "handshake building" honeycomb-like texture. The main streets are 3 to 4 meters wide(Table 4-2 left), with the ground floors of buildings hosting retail, dining, and other commercial activities. Secondary alleys, ranging from 1 to 1.5 meters in width, accommodate activities such as parking electric vehicles or hanging clothes, creating a mixed street scene. Public spaces are relatively scarce, with

farmer's markets, basketball courts, and commercial pedestrian streets concentrated around Yuangang Park(Table 4-2 right), serving as hubs for commercial and service activities.

Table4- 2 Perspective of Current Situation of Urban Villages

(Source: drawn by the author)

Main street	Building spacing	community plaza
		

(2)Residential areas

Residential complexes, developed and constructed in a unified manner, span a wide range of construction periods, including the late 1990s, early 21st century, and post-2015. These complexes primarily serve a single residential function. Overall, the residential complexes within the study area tend to adopt a closed or enclosed layout in terms of planning structure. The ground floors face outward and are used for retail and commercial service facilities, catering to the needs of both the internal and external population. The internal green spaces of the complexes create a tranquil atmosphere, while the external commercial interfaces are more vibrant and dynamic(Table 4-3 right), with relatively continuous building facades and a rich streetscape. In terms of building height, the complexes vary in development density, with common types including 7-story, 18-story, and 26-story buildings(Table 4-3).

Table4- 3 Perspective of the Residential Community

(Source:photo by the author)

7-storey residential community	18-storey residential community	External business interface
		

(3)Small Industrial Parks

Small office parks, developed and constructed in a unified manner, were primarily built around 2010 and are predominantly used for office functions, leased to small technology and new media companies. The internal landscape consists of buildings and surface-level parking lots.(Table 4-4 middle)Some external interfaces are connected by podium buildings, which also provide retail and commercial service facilities, contributing to a higher level of street vitality.(Table 4-4 right)Certain park clusters include sports facilities, public plazas, and commercial service amenities within their internal spaces. In terms of building height, these parks typically consist of 6 to 8-story buildings.(Table 4-4 left)Yuangang Road and Yuangang Cross Road, as major traffic arteries, pass through the small industrial parks.

Table4- 4Perspective of the Small Industrial Parks

(Source:photo by the author)

Internal roads of the industrial park	Interior ground-level parking lot	External business interface
		

(4)Small Factory Parks

Spontaneously developed small factory clusters, primarily built between 2000 and 2010, feature a mixed appearance and function. These areas are mainly dedicated to logistics and warehousing, with some buildings used as small-scale processing workshops. The ground floors facing the street host retail businesses such as restaurants and convenience stores, while the second and third floors are used for residential purposes. The mixture of living and production activities results in a chaotic streetscape, and the quality of street space requires improvement.(Table 4-7 middle)

Table4- 5 Perspective of the Current State of the Small Factory Park

(Source:photo by the author)

frontage	Interior of the building complex	The alleyway space between buildings

(5)Large-Scale Factory Parks

Spontaneously developed large factory parks, mostly constructed between 2000 and 2010, are relatively enclosed internal areas. Different parks within the complex typically focus on distinct industrial sectors. Within the study area, there are two large industrial parks: one for the garment industry and another for grain and oil wholesale. The grain and oil wholesale market consists mainly of single-story buildings made from temporary structures, with surrounding strip buildings offering residential functions. The garment industrial park predominantly features three-story buildings, with some spaces used for small-scale garment production and processing. The open spaces within the parks are used for parking cars, trucks, and non-motorized vehicles. These isolated, production-oriented parks exhibit a clear pattern of high activity during the day but tend to be quiet at night and on holidays, reflecting their spatial attributes.

Table4- 6 Perspective of Large Factory Complexes

(Source:photo by the author)

Clothing Industrial Park	Grain and Oil Wholesale Market	Logistics warehousing park
		

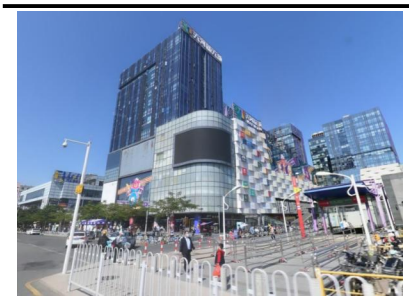
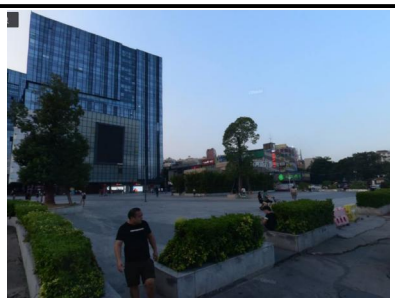
(6) Large shopping mall business building

Large-scale single-building commercial and business office complexes(Table 4-7 left), developed through investment and construction after 2010, are characterized by their mixed-use functions. Taking Tianhe Xintiandi as an example: the lower floors (1st to 4th)are dedicated to retail, dining, and leisure commercial activities, while the 5th to 15th floors are

office spaces leased to small technology companies. The basement level connects to the subway station, providing additional retail and dining services. These complexes feature mixed functions, high foot traffic, and vibrant street interfaces, with the front plaza(Table 4-7 middle)serving as both a transportation hub and a landscaped space. Additionally, there are buildings with commercial spaces on the ground floor and residential apartments on the upper floors. The entire building may function as an office building, with similar architectural forms across these complexes, allowing them to be grouped together as a category.

Table4- 7 Perspective of shopping mall

(Source:photo by the author)

street landscape	The square in front of the building	Building side facade
		

(7)Vocational Colleges

Vocational colleges, built in the 1980s, are typically large, multi-functional architectural clusters consisting of teaching buildings, laboratory buildings, dormitory buildings(Table 4-8 middle), and residential complexes for faculty and staff. These campuses are usually connected to the city's transportation network through 1 or 2 entry points, with relatively enclosed interfaces. Inside, there are public facilities such as open-air sports fields and indoor gyms.(Table 4-8 right)

Table4- 8 Perspective Higher Vocational Colleges

(Source:photo by the author)

Teaching buildings and landscapes	Dormitory area	Sports ground

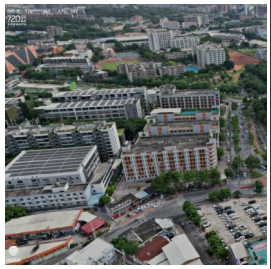
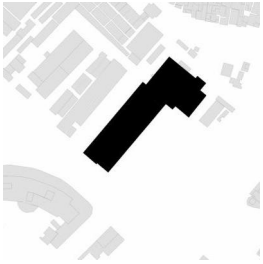
(8)Special Buildings

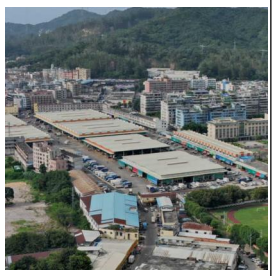
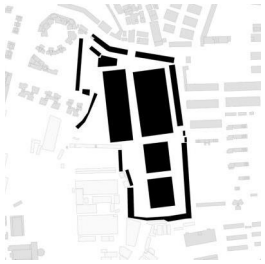
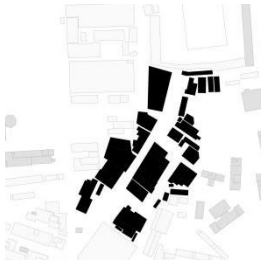
The special buildings within the study area are primarily represented by Tianhe Bus Terminal, a large single-building structure(Table 4-9middle)that integrates multiple functions such as transportation terminals, passenger flow management, and office spaces. The building consists of four floors. Due to its proximity to an elevated bridge and transportation infrastructure, as well as its passenger flow distribution plaza, it plays a significant role in shaping the streetscape of the surrounding area.

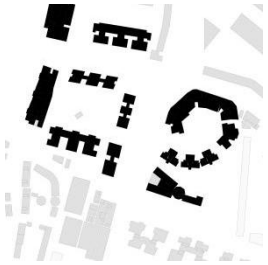
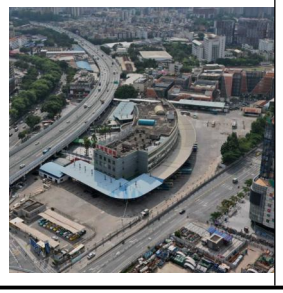
表 4- 1 Perspective of Tianhe Passenger Station(Source:photo by the author)

Street landscape	The side elevation of the building	Underpass space (pedestrian entrance)
		

Table4- 9 Form characteristics corresponds to the functional table
(Source: drawn by the author)

Form District	aerial view	Form characteristics	Planning layout	Land and spacial use
Urban Villages 城中村		Form characteristics: The residential land is fully utilized, and the buildings grow along the lines, forming a "handshake house" pattern. Building height: 6-8 floors Building spacing: Very narrow, 1-1.5 meters Roads: Mainly for pedestrian use within the area. Parking: Parking is located outside the urban village. Public space: Small community park.		Residential areas, mainly for rental purposes and apartments; the first floor of the main streets provides retail businesses, restaurants, hair salons, hardware stores, clinics, and other living services.
Small Industrial Parks 小型产业园区		Building height: 6-7 floors Building spacing: Approximately 10 meters Roads: Inside, it is a mixed traffic area for pedestrians and vehicles Parking: Vehicles can be parked between buildings or the first floor of the buildings can be used as an elevated parking lot Public space: None		The commercial area on the 4th and 5th floors of the podium building is used for retail and catering businesses; the 10th floor is an office building for business purposes, mainly serving small technology companies.
Large shopping mall business		Large single-building Building height: 15 floors Parking: Independent underground parking lot Public space: Square in front of the building		The commercial area on the 4th and 5th floors of the podium building is used for retail and catering businesses; the 10th floor is an office building for business purposes, mainly serving small technology companies.

building				
Large-Scale Factory Parks 大型厂房园区		Large temporary building structure Height: 1 floor. Parking: Parking is conducted on the open space beside the building, and centralized parking is carried out on the open areas within the park. Public space: None		The wholesale market sells dry goods such as seasonings and grains and oils; it also has a mixed retail function, selling vegetables, fresh produce, grains, and seasoning products; the surrounding rectangular buildings provide residential functions.
		Height: 3-4 floors. Parking: The parking spaces are concentrated in the internal open areas of the park. The open areas of the logistics park provide space for large trucks. Public space: Facing the river channel but with a closed interface.		The clothing market park, along with small-scale clothing processing. Wholesale and retail of clothing, and the attached buildings provide residential services.
Small Factory Parks 小型厂房园区		2-3 floors. The first floor is for logistics storage, while floors 2-3 are for living quarters. Parking: Non-motorized vehicles and motor vehicles are parked side by side on the roadside adjacent to the building.		On the ground floor along the street, commercial retail, auto repair, small-scale food processing and other services are provided; for some buildings, the ground floor also houses small production workshops and storage spaces.

Residential areas 居住建筑区		Height: 7 floors; 18 floors; 26 floors Parking: Small ground-level parking lot. Central underground parking lot. Public space: Green area within the community.		Residential area, the ground-level retail commercial space at the exterior interface of the community; surrounding areas are equipped with service facilities such as primary schools and kindergartens.
Vocational Colleges 高职院校		Height: 7 floors Parking: Small ground-level parking lot Public spaces: Internal group green areas, public buildings, etc.		A collection of buildings with multiple functions, including teaching, experimentation, dormitories, and living quarters.
Special Buildings 特殊建筑		Height: 4 floors Parking: At the transportation station, there is a large ground-level parking lot for large buses, buses, etc. Public space: None		Passenger station building. The first floor is for passenger flow gathering and distribution, while floors 2 to 4 are for offices.

4.2.2 Corridor Space Analysis

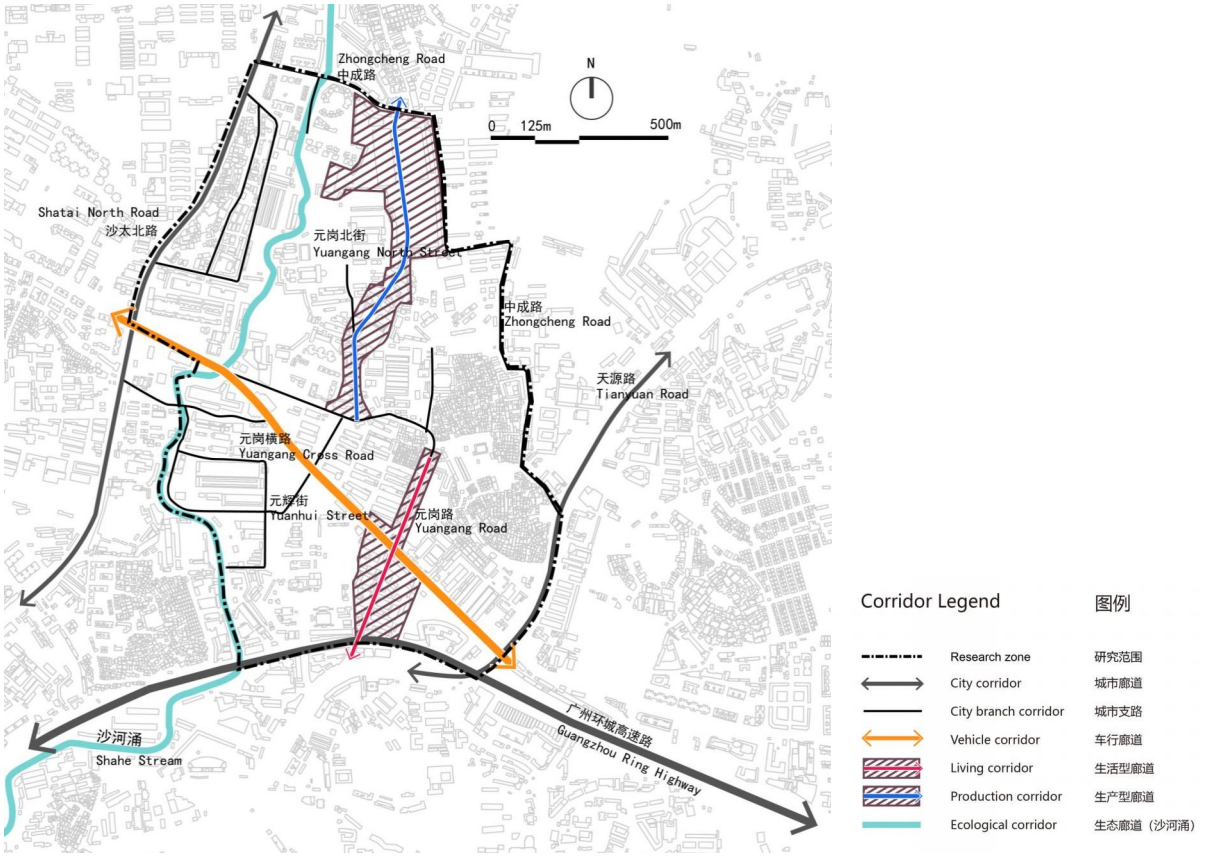


Figure4- 4 Current Corridor Analysis Map

(Source: drawn by the author)

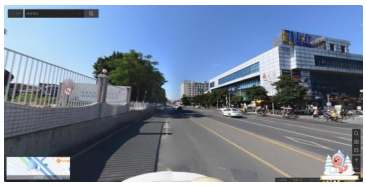
The corridor, as an important urban spatial element, is not merely a road serving transportation functions. Instead, it is an integrated spatial system that combines roads, building facades, and streetscapes. Within the site, there are four significant corridor spaces, as shown in Figure 4-4.

(1) Yuangang Cross Road — Major Traffic Corridor

Yuangang Cross Road is the only east-west urban secondary arterial road running through the site, connecting Sha Tai Road to the west and Tianyuan Road to the east. The road is approximately 30 meters wide, with six lanes in both directions. On the side near Tianhe Xintiandi, there are ground-floor retail shops. Multiple vehicle entry and exit points are distributed along both sides of the road, linking the entrances and exits of small industrial parks and logistics warehouses on either side.

Table4- 10 Traffic corridor section

(Source: Baidu Map)

(2)Yuangang Road — Residential Corridor

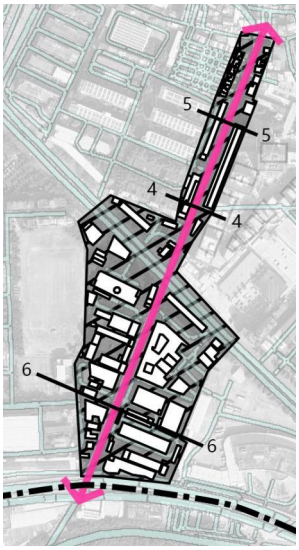


Figure4- 5 Analysis of the Planar Layout of the Habitat Corridor

(Source: drawn by the author)

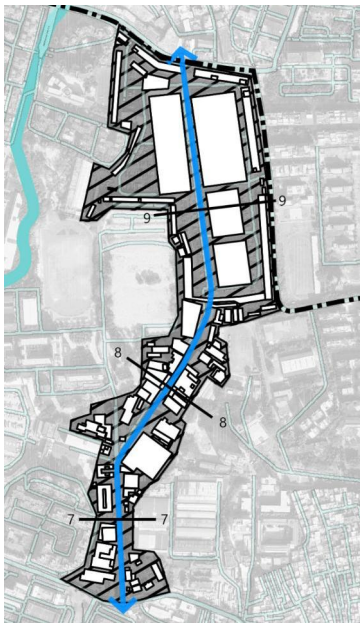
Yuangang Road is an important residential corridor within the site, with a high concentration of commercial service facilities along both sides, offering services such as dining, convenience stores, and Bus Terminals to pedestrians. Since the southern side of this road leads to Tianhe Bus Terminal, there are numerous hotels and accommodations on both sides. Both pedestrian and vehicle entry/exit points are concentrated along this corridor, which provides a variety of residential services, including lodging, pedestrian access, and vehicle access.

Table4- 11 Cross-section View of Yuangang Road

(Source: Baidu Map)

4	5	6
		

(3)Yuangang North Street — Production Corridor

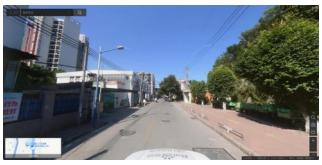


Yuangang North Street is the only road connecting Guyu Market with the north-south roads. This corridor serves the logistics distribution and entry/exit of the wholesale market, as well as north-south public transportation, extending its influence to small factories and large markets. It is a vital production corridor.

Figure5- 1 Analysis of the Planar Layout of the Production Corridor

(Source: drawn by the author)

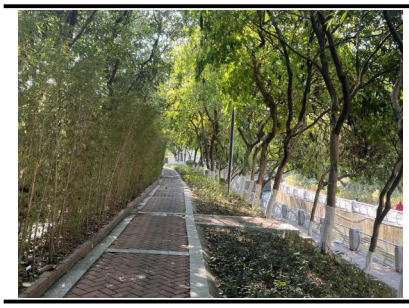
Table4- 12 Cross-section View of Yuangang North Street(Source: Baidu Map)

7	8	9
		

(4)Ecological Corridor — Shahe Stream

Shahe Stream is the only ecological element within the site and also serves as the administrative boundary. Currently, Shahe Stream is relatively fragmented, with some sections featuring waterfront walkways. However, most sections of the creek still have hardened embankments, and the areas along the embankments are occupied by parking lots or the backs of ancillary buildings in logistics parks. As a result, the creek's edge forms a closed interface, preventing pedestrian access. Its ecological and scenic value remains underdeveloped and warrants further exploration.

Table4- 13 A perspective view of the Shahe Stream area(Source: drawn by the author)

7-storey residential community	18-storey residential community	External business interface
		

4.2.2 Road Grade Analysis

From the perspective of road structure hierarchy, there are mainly three levels of roads within the site. The current road layout on the ground is shown in the figure below. Here, one road from each of the three levels is selected as a representative to gain an understanding of the current road situation of the site.

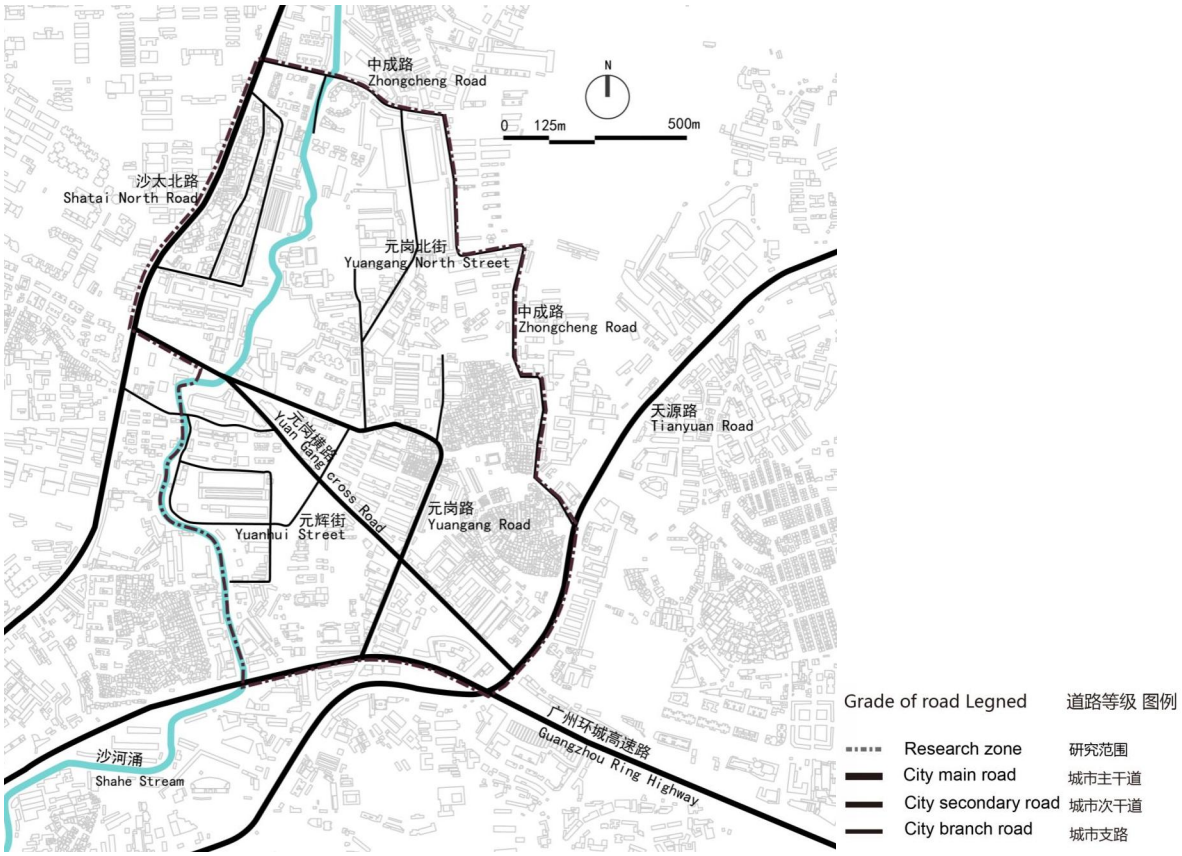


Figure4- 6 Illustration of current road grades

(Source: drawn by the author)

The current road classification system is shown in the diagram. Yuangang Cross Road serves as the main east-west traffic corridor within the site. The site primarily consists of three levels of roads: urban arterials, urban secondary arterials, and urban local roads, with some end roads within the site.

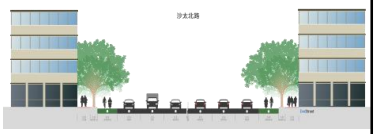
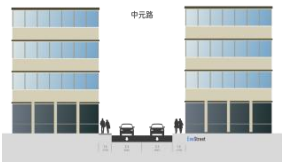
City Main Road(Shatai North Road): Approximately 36 meters in width. This road forms the boundary of the study area and connects with internal roads through vehicular access.

City Secondary Road (Yuangang Cross Road): Approximately 30 meters in width. This road runs east-west through the central part of the study area.

City Branch Road (Zhongyuan Road): Approximately 10 meters in width. This road runs

along the eastern side of the study area.

Table4- 14 Road grade cross-sectional diagram(Source: drawn by the author)

	City Main Road	City Secondary Road	City Branch Road
Sectional drawing	沙太北路 Shatai North Road 	元岗横路 Yuangang Cross Road 	中元路 Zhongyuan Road 
Street view photos			
form characteristics	Motor vehicle lane: Unseparated. Some sections have no markings. Pedestrian lane: Bicycles and non-motorized vehicles occupy part of the pedestrian lane. The pedestrian lane is narrow. Motor vehicle lane: 6-way in each direction Street trees: Present	Motor vehicle lane: Unseparated. Some sections have no markings. Pedestrian path: Bicycles and non-motorized vehicles occupy part of the pedestrian path. Motor vehicle lane: 6-way double lane. There is a green belt in the middle for separation. Street trees: Present	Motor vehicle lane: None. Pedestrian lane: The space between the building's first floor and the remaining part of the motor vehicle lane is used as a motor vehicle lane. Motor vehicle lane: Two-way 2 lanes. Street trees: None

(1)Low Road Density and Poor Connectivity to the City

The entire site is divided by three urban roads and Shahe Stream, with east-west connectivity relying on Yuangang Cross Road. Due to the relatively complex built environment, fragmented land ownership, numerous enclosed areas, and the lack of a cohesive road planning system, combined with the irregular distribution of water systems, the road network in the Yuangang area is disjointed with many dead-end roads. While the internal road density is high within universities and large industrial parks, the urban road network density is extremely low. The enclosed areas mainly consist of large wholesale markets, industrial parks, and logistics/warehousing zones, all of which require high levels of traffic facilities and space for freight, parking, and loading/unloading activities. These zones typically have internal roads and facilities, failing to form a complete system and contributing

to poor connectivity with the city.

(2)Incomplete Road Structure and Lack of Road Facilities

The eastern, western, and southern sides of the study area are bordered by urban expressways or major city roads, which are not suitable for pedestrian-scale streets. Within the study area, only Yuangang Road and Yuangang Cross Road are secondary urban arterials, while the remaining roads are local roads. There is a lack of a more comprehensive traffic transition system between the urban expressways and local roads, resulting in an incomplete road structure. This also leads to a poor walking experience. Furthermore, there is a shortage of temporary parking spaces, non-motorized lanes, and non-motorized parking facilities. For instance, in urban villages, the roads are narrow and barely meet traffic demands, yet they cannot accommodate additional public activities, leading to subpar streetscapes. Yuangang North Street, as the road leading to industrial parks, cannot meet the temporary parking needs for freight loading and unloading, resulting in serious pedestrian-vehicle conflicts. The safety and walking experience for pedestrians need to be significantly improved.

4.2.3 Open Spaces and Enclosed Areas

Within the site, there are numerous enclosed areas with single functions, such as vocational colleges, warehousing and logistics parks, and large industrial parks. These areas are clearly separated from the urban fabric by physical barriers such as walls and ancillary buildings. The connections between these areas and the city are rather limited, primarily relying on vehicular roads as the main form of spatial linkage. This fragmentation disrupts the urban fabric, leading to a chaotic spatial layout.

At the same time, there are also some open spaces and unused land within the site. These open spaces provide areas for pedestrian activities, while the unused land offers opportunities and potential for optimizing the site's public space system.

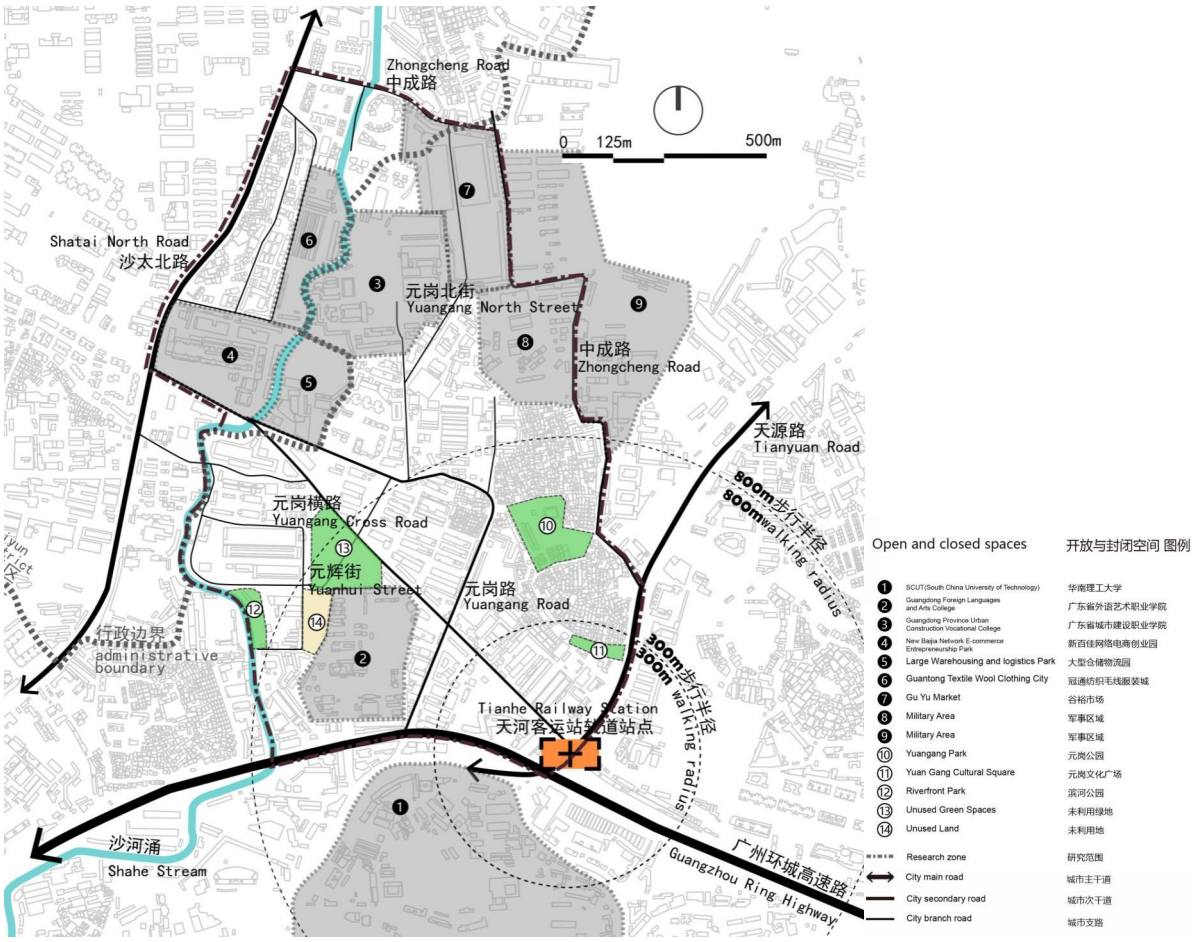


Figure4- 7 Diagram showing the open and closed spaces(Source: drawn by the author)

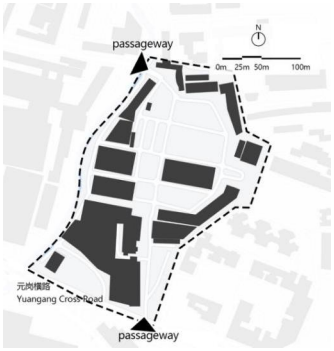
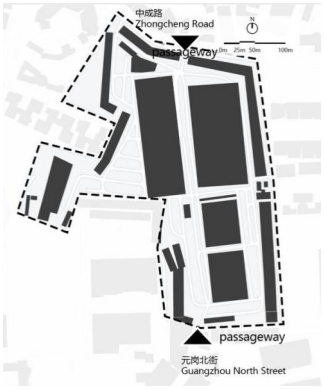
(1)Enclosed Areas

There are several enclosed areas within the site, either as independent administrative units, such as vocational colleges, or as large-scale zones with single functions that require aggregation. The entrances and exits of these areas are primarily vehicle-access roads. The specific spatial layout and relationship of these areas with the city are summarized in the table below.

Figure4- 8 Organization of the elements of the enclosed area shape

(Source: drawn by the author)

Name	Plam	form characteristics	photograph

Guangzhou City Construction College(GZCCC) 广州市城市建设职业学校		An independent administrative area, equipped with various types of building spaces and sports venues. Entrance/Exit: One Function: Teaching, accommodation for teachers and students Boundary: Wall	
Guangdong Teachers College of Foreign Languages and Arts (GTCFLA) 广外艺(燕岭校区)		An independent administrative area, equipped with various types of building spaces and sports venues. Entrance/Exit: One Function: Teaching, accommodation for teachers and students Boundary: Wall	
Large-scale logistics warehousing park 大型物流仓储园区		An introverted large-scale park, with open spaces inside used as parking areas for large vehicles, and the surrounding buildings forming an introverted space. Entrances/Exits: Two Functions: Logistics storage, building materials market, affiliated residences Boundaries: Walls, river course, backside of buildings	 
Gu Yu Market 谷裕市场		Large-scale buildings are temporary structures that provide venues for various functions such as warehousing and wholesale. They are enclosed by strip-shaped buildings to form an inward-oriented park. Entrances and exits: Two Functions: Logistics warehousing, building materials market, affiliated residences Boundaries: Walls, river course, backside of the buildings	 

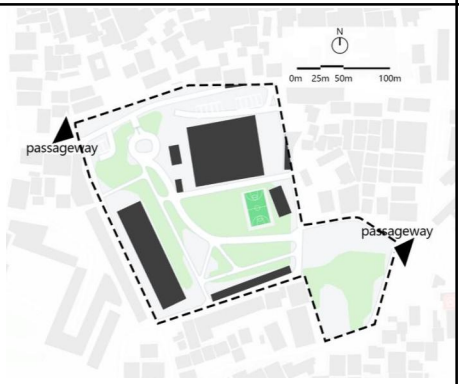
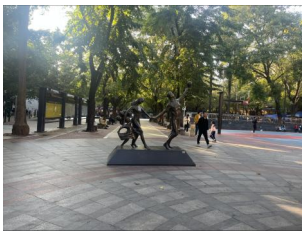
(2)Open Spaces

Within the entire study area, only Yuangang Village is equipped with public spaces that

support various activities. Although there are several rivers and creeks passing through the area, the landscape value of these waterways has not been fully developed. While many river sections have designed waterfront walkways, the connectivity between these walkways and the city is limited due to the enclosed building clusters along both sides of the riverbanks. The plaza on the west side of Yuanyang Tianjiao, combined with the creek, forms a riverside park, which is the only relatively open public space along the river.

Figure4- 9 Organization of the form elements of open areas

(Source: drawn by the author)

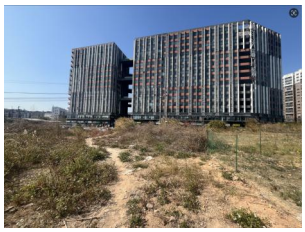
Name	Plam	Description of spatial form	photograph
Yuangang park 元岗公园		The open park in the central area of the urban village features buildings such as a farmers' market and a commercial street to serve the residents. Entrances/Exits: Multiple Functions/Activities: Sports, leisure gatherings	 
Waterfront park 滨河公园		An open square adjacent to the residential community and close to the riverbank, featuring both landscape and ecological value. Entrances and exits: multiple Functions and activities: leisure gatherings, walking tours	 

(3)Unused Land

To the east of Yuanyang Tianjiao, at the boundary with Guangdong University of Foreign Studies, there is a large area of unused land currently covered with overgrown vegetation. At the intersection of Yuanhui Street and Yuangang Cross Road, there is another significant green space, which is currently enclosed. This area holds potential and value to be

developed into an open space in the future.

Table4- 15 unused land from different perspectives(Source:photo by the author)

Look towards the distant Yuanyangtianjiao	Look towards the north.	Look towards GTCFLA
		

4.3 Opportunities and Challenges in Urban Planning

4.3.1 Opportunities for the Upgrading of the Sci-tech Industry

The Yuangang area, as a part of the Huawu Mountain Innovation Source Area and the radiation zone for Tianhe Smart City and the Future Technology Ecological Development Zone, has the potential to accommodate industries such as the digital economy (industrial internet, 5G)and life sciences. This can promote the transformation of traditional, inefficient land uses (such as auto parts markets, logistics warehouses, and wholesale markets)into innovation-driven industrial parks, establishing a base for the transformation of scientific and technological achievements.

The Yuangang area has been incorporated into the "1+N" redevelopment plan of the Huawu Mountain Innovation Source Area, focusing on building high-quality sci-tech industrial carriers, public service facilities, and a convenient transportation network. The plan aims to realize the "Creation (Technology Innovation)— Production (Industry Aggregation)— City (Urban Renewal)" model. The goal is to achieve the triple objectives of urban renewal, industrial upgrading, and improving the quality of life by promoting new models and fostering multi-party cooperation.

Leveraging the concentration of universities and research institutes, the area aims to establish a body for technological innovation and industrial development, adding sci-tech innovation, incubation, and new office spaces. This could attract more high-end enterprises, further driving the region's industrial transformation and upgrading. By continuing the policy guidance and collaboration between government and enterprises for urban village redevelopment and urban renewal, accelerating project approvals, land compensation, and

construction, the area can improve the efficiency of underutilized land. After redevelopment, these areas can be upgraded to high-quality industrial and residential land.

Furthermore, optimizing the road system and public service facilities will promote collaborative development of the surrounding areas, driving high-quality development through industry-city integration and enhancing the city's image.

4.3.2 Opportunities for Transportation Location Enhancement

Opening of Metro Line 10 (End of 2025): The opening of Metro Line 10 will alleviate the pressure on Line 3, strengthening the fast connection with Haizhu, Foshan, as well as Tianhe Smart City and the Financial District. This will improve commuting efficiency and increase the regional value of the Yuangang area.

In the first phase of the Yuangang project, the control plan includes the addition of three new secondary roads and optimization of the secondary and local road system. These improvements will enhance traffic micro-circulation and support the efficient linkage between industry, city, and people, contributing to the integrated development of the area.

4.3.3 Urban Renewal to Unlock Spatial Potential

The urban renewal of areas like Changban Village (with a 24.5 billion yuan renovation plan)and Yuangang Village will release valuable land resources. The planning includes an additional 488,500 square meters of building space, incorporating commercial, residential, educational, and ecological land uses to promote a balanced mix of work and living spaces.

In the control plan, existing village residential land (Category II residential land), economic development land (Category I industrial land), Category I industrial land, and sports land will be converted into Category II residential land, other commercial land, primary and secondary school land, service facilities land, park green space, and cultural heritage land. Additionally, 39 new public service facilities will be added (including a 36-class nine-year school, kindergarten, and community health stations), which will increase the coverage of the 15-minute living circle to 90%, enhancing the area's community appeal.

Shahe Stream has been included in Guangzhou's "Five Corridors" ecological and leisure corridor plan, with efforts to improve the hardened canal banks and construct waterfront greenways and pocket parks. These initiatives aim to enhance the ecological quality and

residents' living experience. The plan also preserves cultural heritage land, exploring the integration of traditional culture with modern functionality, and creating unique cultural identifiers for the area.

4.3.4 Challenges in Sustainable Industry-City Integration Development

The exit of traditional industries (such as the grain and oil wholesale market)requires coordination between short-term economic returns and long-term transformation goals. The construction of sci-tech park infrastructures and the introduction of emerging industries face intense regional competition, necessitating precise matching of enterprise needs and policy support. Public service facilities (such as schools and hospitals)need to be built simultaneously with residential areas, which presents challenges in terms of funding, scheduling, and may delay the overall renewal progress.

Projects that require long-term operation, such as long-term rental apartments and sci-tech parks, may face issues like high vacancy rates in the early stages and long return periods. These projects will need innovative investment and financing models (such as Public-Private Partnerships, PPP). Additionally, the integration of new populations with the original residents, and the operation and maintenance of public service facilities, require the establishment of a shared governance mechanism among the government, enterprises, and residents to avoid the issue of focusing on “rebuilding while neglecting management.”

Moreover, the urban village transformation involves multiple stakeholders, including original residents, village collectives, and developers, creating potential conflicts over demolition compensation and resettlement plans. Balancing short-term interests with long-term development goals is crucial to ensuring social stability.

The Yuangang area is poised for a historic development opportunity, driven by sci-tech empowerment, transportation upgrades, and the benefits of urban renewal. However, it must address core challenges such as industrial transformation, interest coordination, ecological collaboration, and long-term operation. It is recommended that the area adopt the principles of "sci-tech-driven, people-centered, and flexible management," and through policy innovation, government-enterprise collaboration, and public participation, push the area’s transformation from “inefficient stock” to a “high-quality industry-city integration

demonstration zone." This will provide a practical example for urban renewal and sci-tech corridor development in Guangzhou.



Figure4- 10 Overall Map of Tianhe District's Land Space Master Planning

(Source:Guangzhou Urban Planning and Natural Resources Bureau)



Figure4- 11 Illustration of the planning for the Line 10 subway line

(Source:Guangzhou Transportation Bureau)



Figure4- 12 The control detailed plan scope of the first phase project of Yuangang

(Source: Guangzhou Urban Planning and Natural Resources Bureau)

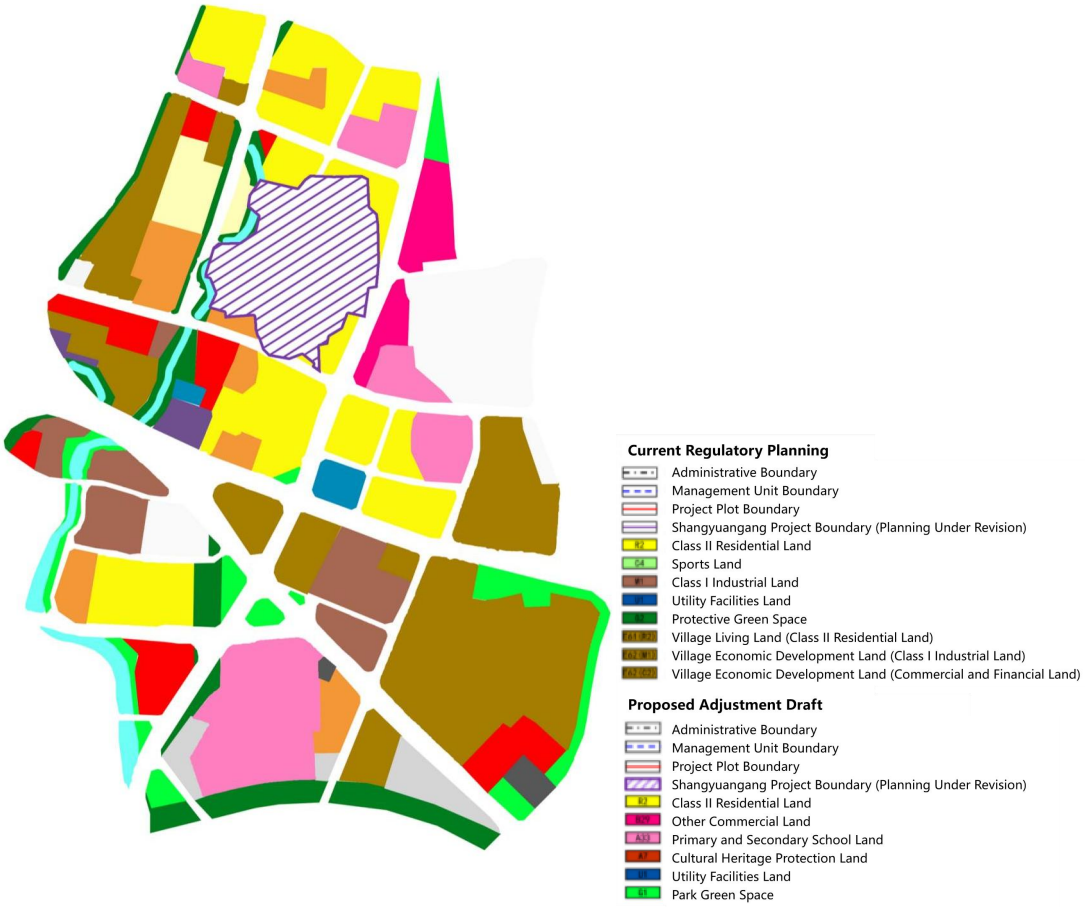


Figure4- 13 The adjusted detailed planning within the study area

(source: drawn by the author based on the public announcement materials)

4.4 Summary of The Chapter

This chapter serves as a transitional link, systematically constructing an analytical framework for applying FBCs to the Yuangang area. It provides an in-depth analysis of the site's current conditions, laying a solid theoretical and situational foundation for the subsequent development of targeted design strategies.

Firstly, this chapter clarifies the application methods of form principles in the Yuangang area. Two core approaches are proposed: "comprehensive understanding of spatial elements across all scales" and "understanding of urban-level form elements." The former emphasizes systematic control across three interrelated scales: district, block, and building. The latter introduces neighborhood, corridor, and district as core spatial elements to construct the design framework. This approach replaces traditional functional zoning and provides a

methodological guide for the organic integration of morphology and function within the complex built environment of Yuangang.

Secondly, this chapter presents a thorough, multi-dimensional study of the site's current conditions. The research covers not only the macro development history and location but also offers an in-depth analysis from various perspectives such as Form District, corridor spaces, road hierarchy, and open vs. closed areas:

Form district Study: The research accurately identifies and categorizes nine major Form districts within the site (e.g., urban villages, various industrial parks, residential areas, etc.). Through the use of charts and diagrams, the study details the typical characteristics of each zone in terms of building form, function, street interface, and public spaces. It clearly reveals the core issues of the area's fragmented spatial structure and mixed urban fabric.

Corridors and Roads Study: The analysis highlights systemic issues within the existing road network, such as low density, poor connectivity, and incomplete structure. It also examines the spatial attributes and deficiencies of four major corridors, especially pointing out the untapped potential of Shahe Canal as an ecological corridor.

Open and Closed Areas Study: The research identifies the disruptive effects of closed areas like vocational colleges and large industrial parks on the urban fabric. It also points out the shortage and uneven distribution of open spaces, while recognizing the untapped potential of underutilized land for future renewal.

Finally, the chapter places the site's current conditions within the broader context of urban planning, systematically analyzing the opportunities and challenges faced by the Yuangang area. The opportunities include innovation-driven industrial upgrades (e.g., the Wushan Innovation District), transportation improvements (e.g., the opening of Metro Line 10), and the spatial potential released through urban renewal policies (e.g., old-town reconstruction and zoning adjustments). The challenges primarily revolve around industrial transformation, interest coordination, synchronized infrastructure development, and the sustainable integration of industry and city.

In conclusion, this chapter demonstrates the necessity and applicability of applying FBCs to the Yuangang area—an area characterized by complex functions, fragmented ownership, and a disjointed spatial structure—by establishing an application framework,

conducting an in-depth analysis of current conditions, and evaluating the development context. It clearly identifies the core issues of the present and the potential for future development, providing a foundation for the subsequent overall design and form guidelines.

Chapter 5:Yuangang District Master Urban Design: Vision, Strategies, and Form-Based Control"

5.1 Overall Design Vision and Principles

This chapter adopts the spatial elements of neighborhood, corridor, and zoning as the overall design framework: replacing functional zoning with form-based zoning; integrating traffic and public space attributes to propose a four-level street hierarchy and build a corridor system; and substituting single-use land parcels with a whitelist-based land-use approach. In line with the upper-level planning vision for the area, it further proposes strategies and schemes for spatial renewal.

5.1.1 Overall Design Vision

Short-term (2025-2028): Establish Yuan'gang as a science and innovation service portal, creating a model community for industrial-urban integration.

Yuan'gang will be developed as a community-level center integrating industry, residence, and commerce, aiming to build a competitive science and innovation service hub. The area will incorporate office spaces, conference centers, innovation hubs, and incubation facilities, leveraging nearby universities and research institutes to attract businesses. The goal is to create a dynamic residential community, enhance public service facilities, and maintain attraction for talent and investment.

Long-term (2029-2035): Establish Yuan'gang as a highland for the transformation of science and innovation achievements, creating a livable and business-friendly innovation district.

The plan is to develop an industrial space cluster that benefits from scale and agglomeration effects, creating a high-quality industrial-urban integrated new district. This will involve adding more community service and activity facilities, ensuring the sustained vitality of community development. Given that Yuan'gang is a high-density area with complex property ownership and mixed functions, it faces challenges in terms of long renovation cycles and uncertain scope in urban renewal. As such, the current design will focus primarily on the short-term (2025-2028)goals and spatial outcomes.

5.1.2 Overall Design Principles

Based on the aforementioned potential for renewal and opportunities, the following overall urban design principles are proposed:

(1)Innovation-led, Industrial-Urban Integration

Relying on the Huowushan Innovation Source Zone, the design prioritizes the layout of spaces for scientific research, achievement transformation, and incubation, forming a "university-enterprise-community" network. Through mixed-use development of business, residential, and service spaces, the project will promote a balance between work and residence, reduce commuting pressure, and create a complete innovation-oriented living circle.

(2)Ecology First, Resilient Development

The ecological corridor along Shahe Creek will be protected and restored, with the development of continuous waterfront greenways, pocket parks, and sponge city facilities to enhance the area's ecological resilience. The construction of ecological corridors will serve as the foundational strategy for improving the area's spatial quality. New buildings and public spaces should integrate green, low-carbon technologies (e.g., vertical greenery, photovoltaic roofs)to support the "dual carbon" targets.

(3)Human-centered Services, Quality Improvement

The design aims for a fully integrated 5-minute living circle, addressing gaps in public services such as education, healthcare, and cultural facilities. Key community amenities will include canteens, childcare facilities, and smart fitness spaces. Pedestrian and non-motorized transport systems will be optimized to connect metro stations, community centers, and ecological spaces, creating a safe and continuous network for public activities.

(3)Transportation Optimization, Efficient Connectivity

The design strengthens connections to metro stations, enhances integration with surface public transport, and introduces microbus circular routes to improve connectivity with Line 10 and Line 3. The internal road network will be optimized by densifying the secondary road system and implementing a "small blocks, dense road network" model to alleviate traffic congestion.

(4)Flexible Growth, Dynamic Update

A "blank space for greenery" strategy will be adopted, reserving flexible land to meet future industrial upgrade needs. Urban renewal will be phased, with a focus on the construction of public service facilities and industrial infrastructure, ensuring social stability throughout the renewal process.

5.2 District Update Strategy

5.2.1 Overall Update Strategy for Districts

This design is based on the planning scheme of the Huowushan Innovation Source Zone, fully considering the land integration plan for the existing Yuan'gang Village area under the leadership of this project. By demolishing certain parts of Yuan'gang Village's existing land, industrial space will be released, serving as the starting point for the spatial design. The project will re-integrate three spatial elements: roads, old and new buildings, and public spaces, from the perspective of form principles. This will establish new spatial elements such as zoning, corridors, and a five-minute living circle.

Figure 5-1 illustrates the overall framework strategy of the renewal design. Under the development of the Huowushan Science and Innovation Source Zone, the area will be developed from the perspective of industrial, innovation, and urban integration, creating a closer connection between the residential areas and industrial parks. This new urban pattern will emphasize functional mixing and open sharing, raising further requirements for transportation, functionality, commercial services, the quality of open spaces, and other facilities.

(1)Use Yuan'gang North Street as an important axis to connect the northern and southern parts of the site. Commercial services, pocket parks, and various types of buildings will be integrated along both sides of the road, creating an open and continuous street frontage to develop a comprehensive service corridor.

(2)Strengthen the east-west traffic connections of the site, relieving congestion along Yuan'gang Horizontal Road, and improving road network accessibility and the overall completeness of the road system.

(3)Fully exploit the ecological landscape value represented by Shahe Creek, developing an

open ecological corridor. Pocket parks, linear green spaces, and other elements will be used to integrate the ecological landscape into the east and west sides of the site, activating the urban space through open, green views.

(4)Create four 5-minute living circles centered around residential areas, supplementing commercial services, public activities, and other civic spaces.

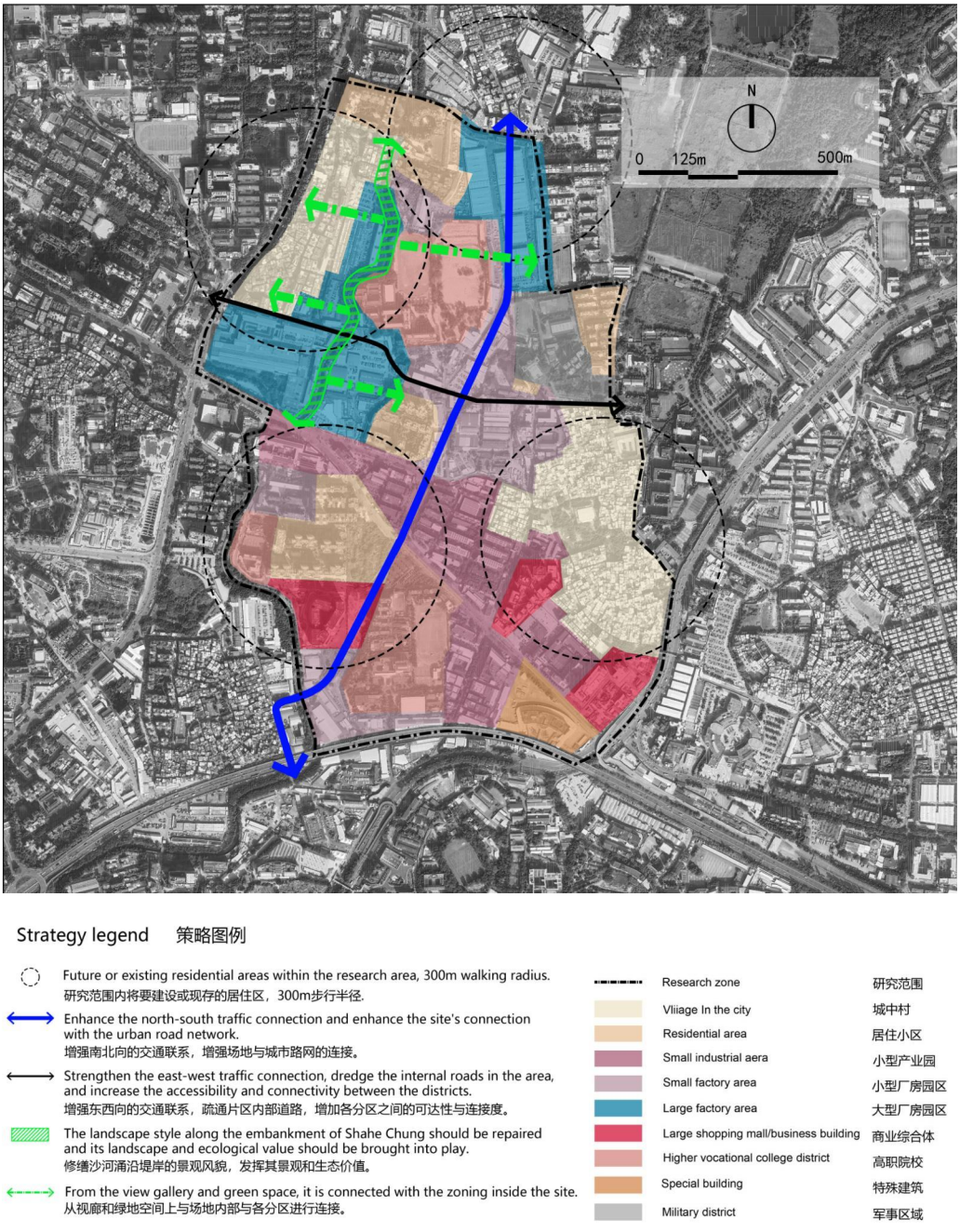


Figure5- 2 Planning Strategy Diagram

(Source: drawn by the author)

5.2.2 Update Strategies for Various Form Zones

(1)Urban Villages

Reorganize the road network to enhance pedestrian accessibility and establish multi-level centralized parking areas.

Supplement public service facilities such as healthcare and medical services.

Limit functions and activities that impact residents' daily lives.

Where feasible, **add green spaces, plazas, and other public areas.**

(2)Residential Communities

Further improve facilities such as kindergartens and commercial services.

Strengthen the connections between ground-floor commercial spaces and the surrounding environment.

Optimize and supplement green spaces and plazas for better community engagement.

(3)Small Industrial Parks

Connect ground-floor businesses to the surrounding area to facilitate interaction.

Shared services, such as parking, can be provided in collaboration with the city.

Increase spaces for shared offices, open-plan workspaces, and meeting rooms.

Add mixed-use spaces (e.g., business-residential combinations)to offer a variety of services.

(4)Small Factory Parks

Some areas may be transformed into small industrial parks or residential zones.

The update of the old factory areas will adopt three methods: demolition and reconstruction, partial demolition, and full retention.

In the context of industrial upgrading, consider the demand for tech and innovation-driven enterprises.

Increase office spaces, meeting rooms, and discussion areas while shifting and reducing warehousing, logistics, and small workshop functions.

Optimize the landscape, open spaces, and street frontages to improve urban aesthetics.

(5)Large Factory Parks

Reduce the scale and area of large factories.

Some areas may be converted into small industrial parks or residential zones.

Use the three methods of demolition and reconstruction, partial demolition, and full retention for updating old factory areas.

Enhance the landscape, open spaces, and ensure the open spaces are closely connected with the water channels.

(6)Commercial Complexes

Enhance the connection between ground-floor commercial spaces and the urban fabric. Optimize the design of public squares in front of buildings and encourage activities that increase foot traffic.

(7)Vocational Colleges

In line with higher-level planning, convert certain areas into small industrial parks. Retain the existing architectural style and offer visual corridors for the city's landscape. Where conditions permit, share sports facilities with the public.

(8)Special Buildings

Enhance transportation and traffic flow to accommodate high traffic volumes. Optimize the city street scene and the relationship between pedestrian and vehicle traffic.

5.3 Overall Road and Traffic Design

The general principles of road planning include: connectivity and completeness of the road network structure, respecting existing construction conditions, pedestrian-friendliness (small block, dense road network), public transportation adaptability (feeder buses), streetscape and service facilities.

5.3.1 Connectivity and Completeness of the Road Network Structure

This design aims to enhance the connectivity between the site and the city, as well as internal road connectivity, to address the fragmentation and disjointed road issues caused by large, enclosed industrial parks. The design requires strengthening the north-south connectivity by expanding Yuan'gang North Street, forming a continuous urban secondary road from Zhongcheng Road in the north to Yuan'gang Horizontal Road in the south.

At the same time, east-west connections need to be reinforced by adding a vehicular road link between Sha Tai North Road and Zhongcheng Road, improving the transportation connections between urban villages, large industrial parks, and the city.

Internal roads within the area should be revitalized, organizing traffic and pedestrian flow to form a systematic, networked road structure. This will create a three-tiered road network system: primary urban roads — secondary urban roads — local urban roads.

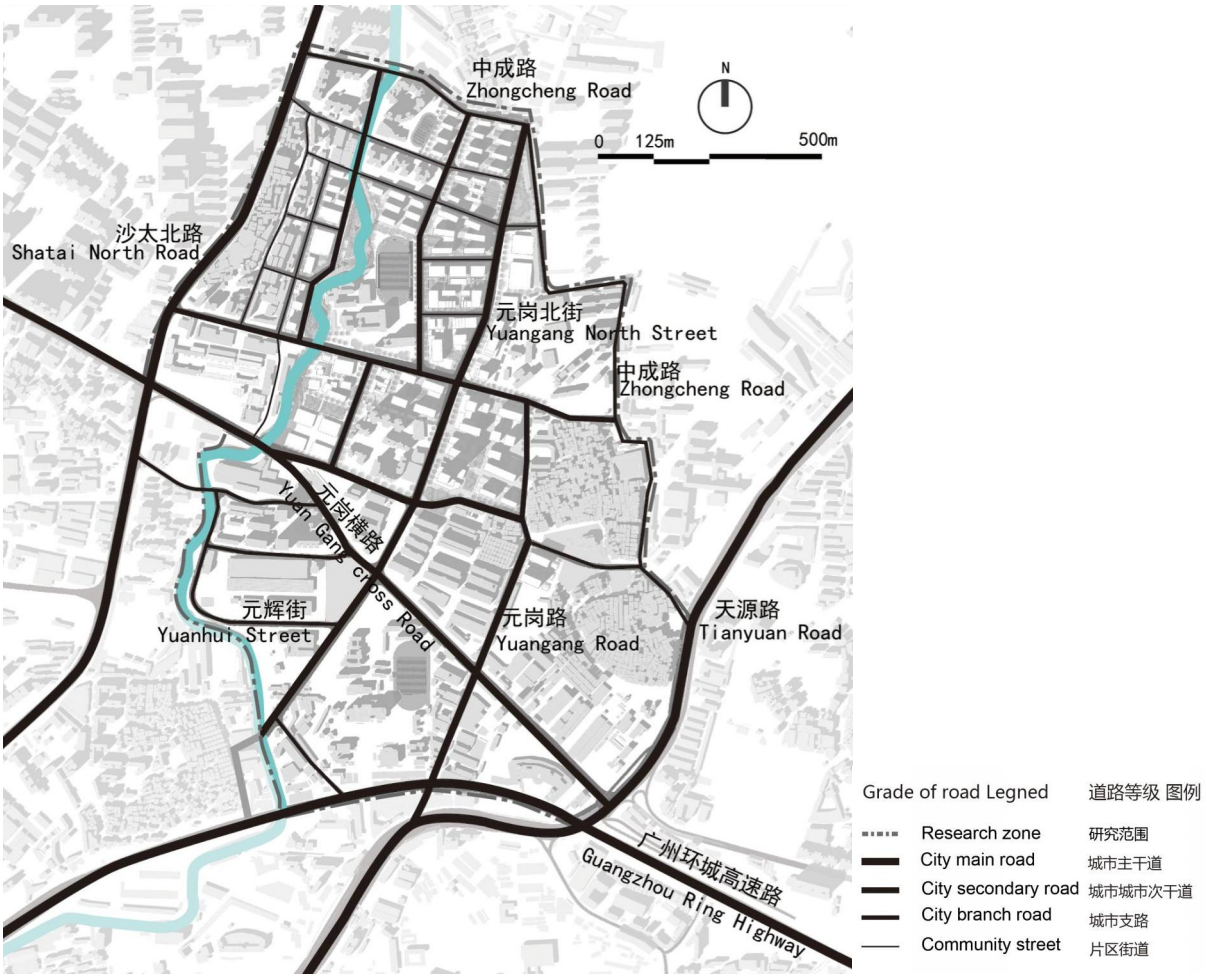


Figure5- 3 Road grade diagram

(Source: drawn by the author)

5.3.2 Respect for Existing Construction Conditions

The new roads will be designed to align with the existing topography, taking into account the presence of existing buildings. According to the planning control documents for the first phase of the Yuan'gang project, all areas except the current Gu Yu Market will be preserved. Efforts will be made to retain the built environment in other zones, maximizing the use of open spaces, underutilized large parking lots, and other available land for road construction. Areas such as small factory parks and large factory parks, which are not suitable for industrial transformation and upgrading, will be excluded. The design will aim to minimize the impact on existing buildings and the surrounding environment.

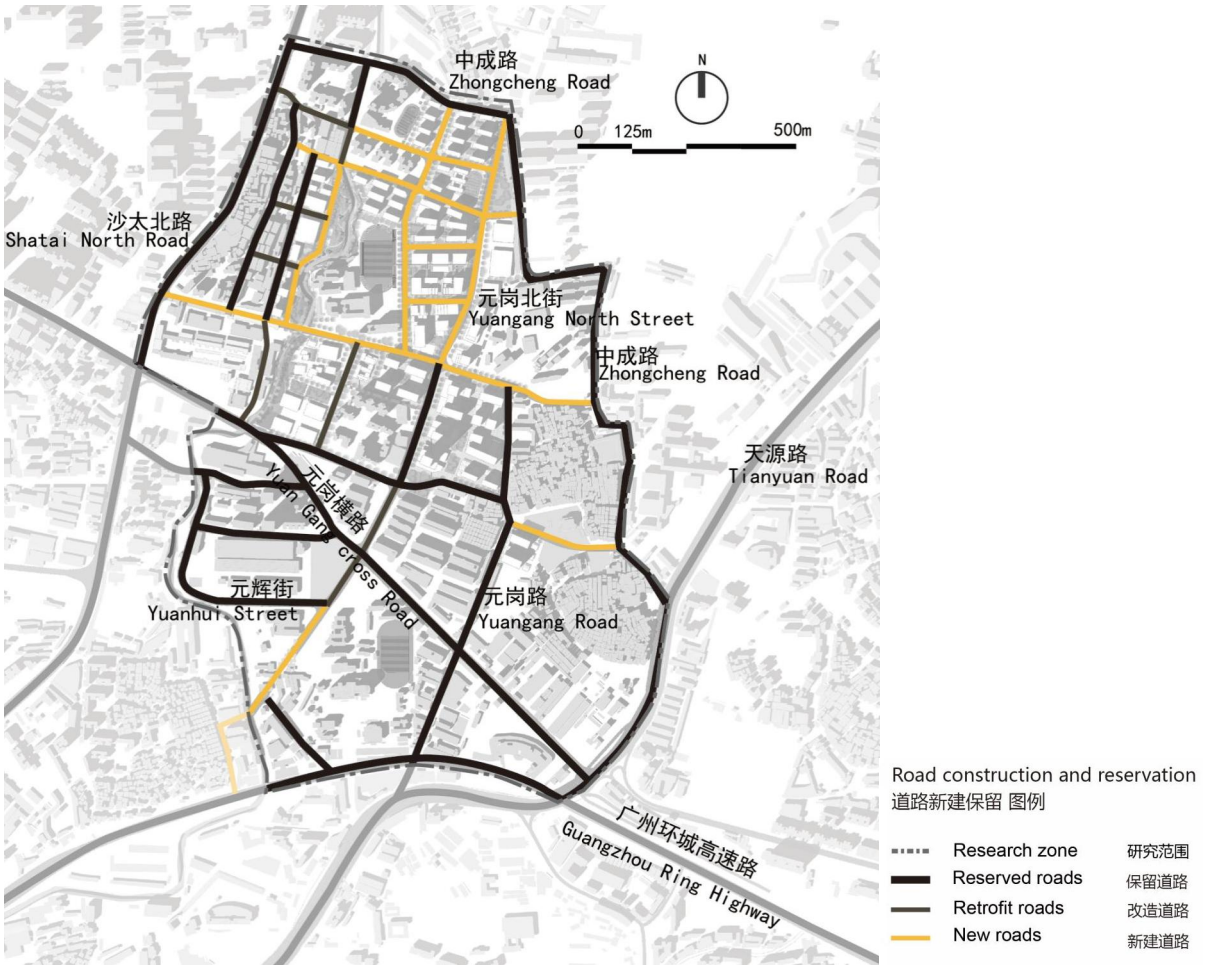


Figure5- 4 Diagram of road demolition and reconstruction

(Source: drawn by the author)

5.3.3 Walkability

The design will fully consider and respect the existing built environment, ensuring that new developments integrate harmoniously with the current structures and landscape. Efforts will be made to preserve key existing buildings and infrastructure, minimizing disruption to the established urban fabric. In areas where construction is unavoidable, the approach will prioritize adaptive reuse and strategic interventions that maintain the architectural integrity of the area. The layout of new roads and transportation networks will be designed to fit into the existing environment without causing significant impacts on surrounding buildings, public spaces, or the overall urban context. Furthermore, areas with underutilized land, such as vacant plots or low-density parking lots, will be optimized for road construction, ensuring that the existing built environment remains intact while accommodating necessary infrastructure upgrades.

Table5- 1 The sizes of the plots in different areas

(Source: drawn by the author)

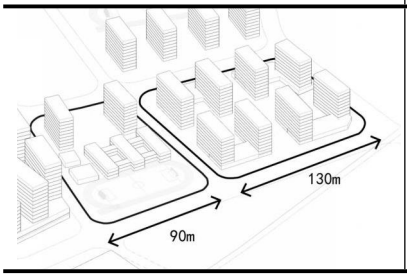
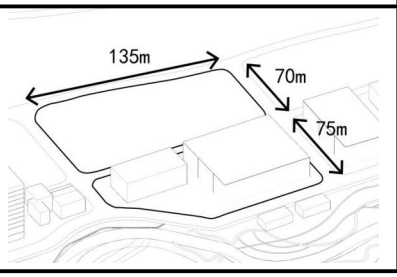
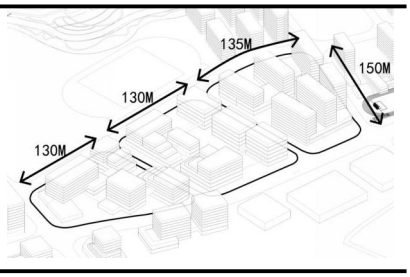
北部居住社区	西部产业园区	东部产业园区
		

Table5- 2 Table showing the corresponding curb stones for different grades of roads

(Source: drawn by the author)

	城市主干道	城市次干道	城市支路	街区巷道
城市主干道	20m	10-12m	不考虑	不考虑
城市次干道	-	6-8m	8-10m	3-6m
城市支路	不考虑	-	6-8m	2-3m
街区巷道	不考虑	-	-	2-3m

5.3.4 Road Update Strategies for Various Form Districts

(1)Urban Villages

Reorganize the road network to ensure smoother connections with the city’s road network, enhancing pedestrian accessibility.

Construct multi-level centralized parking facilities to address parking demands.

(2)Residential Communities

Improve pedestrian-friendliness between the northern residential areas.

Consider the transition between new residential communities and city roads, ensuring smooth integration into the urban context.

Activate the ground-floor interface with commercial spaces to increase activity and vitality.

(3)Small Industrial Parks

Retain city roads, with partial road widening and renovation to meet the overall road network structure needs.

Share parking and service facilities with the city to improve space utilization and efficiency.

(4)Small Factory Parks

Some areas may be converted into small industrial parks or residential zones, requiring the addition of more roads and considering pedestrian-friendliness.

Provide centralized ground-level parking to accommodate vehicular needs in the area.

(5)Large Factory Parks

Some areas may be converted into small industrial parks or residential zones.

Release land currently occupied by large parking lots and the vacant spaces within the large factory zones, especially on the west side of Shahe Creek, to accommodate new city roads.

(6)Commercial Complexes

Enhance the connection between ground-floor commercial spaces and the city.

Optimize the design of the public square in front of buildings, facilitating events to attract foot traffic and increase activity.

(6)Vocational Colleges

Based on higher-level planning, convert certain areas into small industrial parks.

New roads will be constructed to meet the functional needs of these areas, and the road layout will redefine the boundaries of certain zones.

(7)Special Buildings

Optimize vehicle and pedestrian flow within the site, ensuring a smooth circulation system.

Improve streetscape design to enhance the visual and functional quality of the urban environment.

5.4 Form district Plan

5.4.1 Overall Form District Plan

This section defines the Form District within the study and design areas. These zones are based on the analysis and optimization of the building clusters within the research scope. Most areas feature a mix of land uses. This approach differs from traditional regulatory planning methods, which typically segregate residential, commercial, industrial, and public service functions into separate zones. Such segregation often leads to isolated and disorganized urban forms, requiring residents to rely on cars or public transportation for their daily activities.

The morphological guidelines are based on development intensity and spatial form as the foundation for spatial development. These guidelines directly reflect the spatial connections between various zones. In some cases, zoning boundaries are not defined strictly by road edges, emphasizing the desire to maintain attractive connections between different areas.

The design establishes the building types within the planning area and sets parameters for building volume. Figure 5-5 highlights the 14 zones within the study and planning areas. These zones have been delineated based on a comprehensive consideration of existing traffic patterns, building forms, development intensity, and functional and form district.

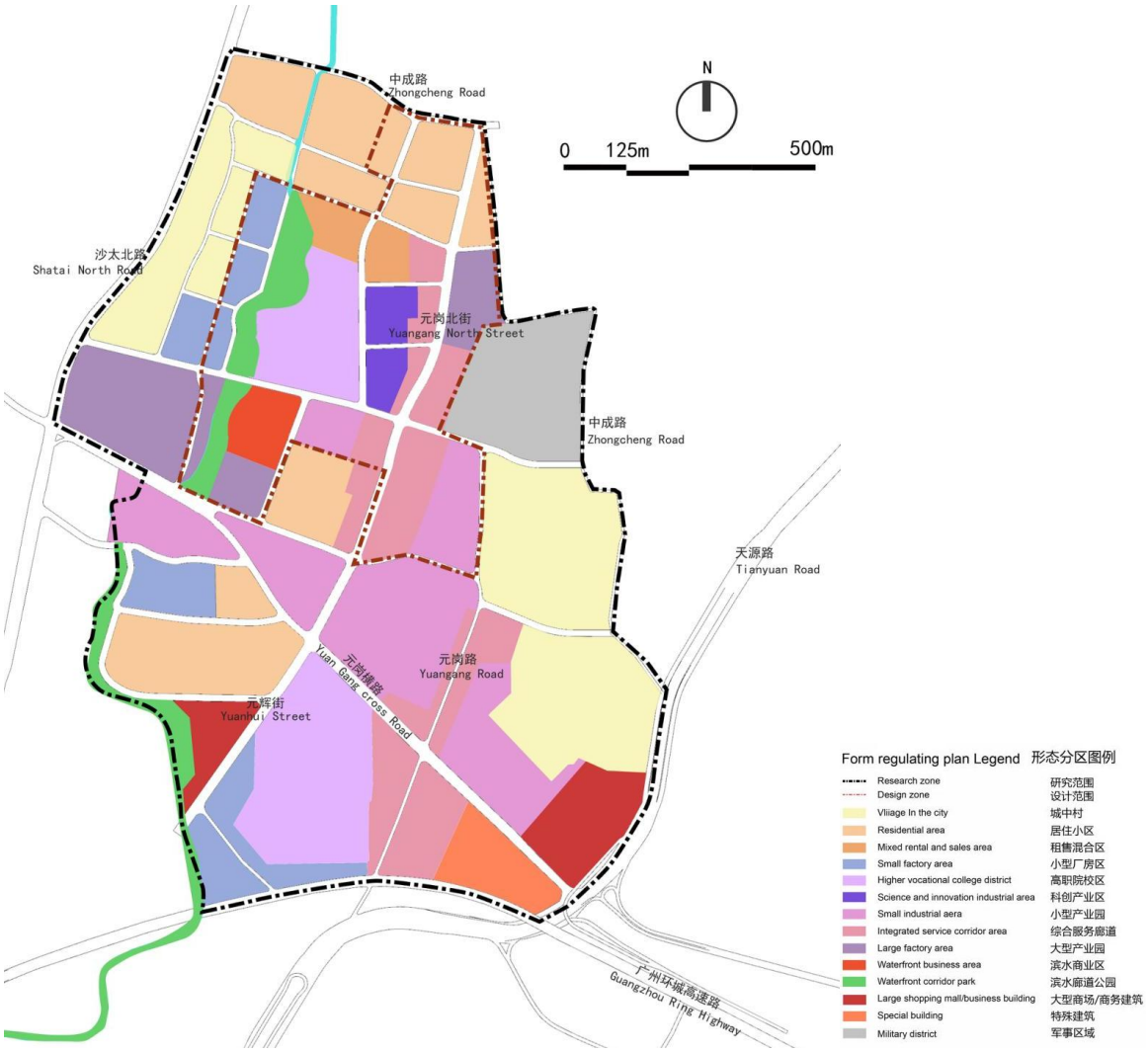


Figure5- 5 Regulating Plan

(Source: drawn by the author)

5.4.2 Update Strategies and Requirements for Each Form Districts

The design scope does not overlap with the research scope; the specific range is shown in the red area of Figure 5-5. The design area consists of ten morphological zones, each with specific spatial construction requirements as outlined below.

(1) Residential District

Located south of Zhongcheng Road, this area is currently occupied by large factories. The design aims to convert this space into a concentrated residential community for relocation purposes during the subsequent urban village redevelopment. It will also provide housing for the population attracted by industrial upgrades. The zone accommodates various building types, including slab, courtyard, and other architectural forms. The ground floor will host pedestrian-oriented uses such as retail, dining, and entertainment. Seating, shading, and tree planting will be provided along the streets, activating the street interface. Green spaces will be

integrated within the building clusters to enhance internal vitality. Temporary parking spaces and underground parking facilities will be provided along the street.

(2) Mixed Rental and Sale District

Located south of Zhongcheng Road, this area is currently occupied by large factories and vacant land. The design converts it into a mixed-use residential and apartment zone, serving as housing for the population attracted by industrial upgrades. The zone will accommodate various building types and provide public activity-oriented spaces such as audio-visual rooms, activity rooms, and gyms on the first and second floors. The use of terraces and platforms will create diverse spatial layers. Retail, dining, and entertainment uses will be located on the ground floor, with architectural features like canopies and outdoor seating. Temporary parking spaces, non-motorized parking, and underground parking will be provided.

(3) Innovation and Technology Industry District

Located east of Guangzhou Urban Construction College, this area is currently occupied by large factories and vacant land. The design converts it into industrial office spaces. The zone will accommodate a range of architectural forms, including courtyard and stepped buildings. Shared spaces such as audio-visual rooms, meeting rooms, and cafes will be provided on the first and second floors to encourage communication, discussion, and research. Terraces and platforms will create rich spatial layers. The ground floor will feature pedestrian-oriented uses like retail and dining. Urban landscapes with tree pools and plazas will be integrated into the street design. Temporary parking spaces and underground parking will be provided along the street.

(4) Comprehensive Service Corridor

Located along both sides of Yuangang North Street, this linear space serves as a regional service area with a central urban secondary road. The area is currently home to small and large factories. The design converts it into a mixed-use space with services such as office spaces, conference facilities, commercial retail, and residential areas. These will serve the population attracted by industrial upgrades. The buildings will include a variety of forms, such as slab, courtyard, stepped, and tower structures. The first floor will feature pedestrian-oriented spaces like commercial retail, dining, and fitness centers. The use of courtyards, terraces, and platforms will create spatial layers. Canopies, outdoor seating, and temporary parking spaces will be encouraged, along with underground parking.

(5) Waterfront Commercial Area

Located south of Guangzhou Urban Construction College and east of Shahe Creek, this area is currently occupied by large factory zones. The design will transform it into a

waterfront commercial district with district-style buildings and landscapes. This will provide high-quality commercial space for the region after industrial transformation. The design will use flexible building volumes to create dynamic relationships between streets and buildings, with an open ground floor interface. The internal streets will feature flexible hardscaped landscapes, tree pools, and green spaces, creating spatial layers. The area will include water platforms and public squares by the creek. Retail, dining, and entertainment uses will be integrated on the ground floor, with architectural features like canopies and outdoor seating. Temporary parking and underground parking will also be provided.

(6) Waterfront Corridor Park

Located west of Guangzhou Urban Construction College, this area is currently occupied by ancillary buildings and parking lots of large factories. The design will convert it into a waterfront corridor park, offering high-quality public space and ecological environments. This will enhance the attraction and vitality of the area. The natural river channel will be utilized to provide seating, water platforms, and other facilities, creating diverse landscape spatial layers. A concentrated surface parking area will be developed.

(7) Vocational College District

This zone retains Guangzhou Urban Construction College, including the teaching area and sports facilities. The factory area to the east of the original teaching section will be released for innovation and technology industry space. The design will add urban roads to improve overall connectivity and road network integrity. The spatial quality will be optimized, further enhancing the attractiveness and vitality of the area. Existing architectural squares and green open spaces will be utilized to form rich landscape layers. The sports field may be opened to the public as shared infrastructure, and concentrated surface parking will be added.

(8) Small Factory District

Located west of the ecological corridor, this small factory park will retain its logistics, warehousing, and light manufacturing functions. The environment will be optimized, and a variety of building types, including slab and courtyard buildings, will be accommodated to support industrial diversification. Spatial quality will be enhanced to further increase the area's attractiveness and vitality. Existing squares, green open spaces, and landscape layers will be utilized. The ground floor will include pedestrian-oriented uses such as retail, dining, and entertainment, with seating, shading, and tree planting along the streets. The street will integrate with the ecological corridor on the east side. Temporary parking and surface parking areas will be provided.

(9) Small Industrial Park

Located east of Guangzhou Urban Construction College, this area is currently occupied by large factories and vacant land. The design will convert it into industrial office space. It will accommodate a variety of building types, such as courtyard and stepped buildings. The first and second floors will feature shared spaces such as audio-visual rooms, meeting rooms, and cafes for communication and research. Terraces and platforms will be utilized for rich spatial layers. The ground floor will include pedestrian-oriented spaces such as retail and dining. Urban landscape features like tree pools and plazas will be added. Temporary parking spaces and underground parking will be provided.

(10) Large Industrial Park

Located east of Guangzhou Urban Construction College, this area is currently occupied by large factories and vacant land. The design will convert it into industrial office spaces, accommodating a range of architectural forms, including courtyard and stepped buildings. Shared spaces like audio-visual rooms, meeting rooms, and cafes will be available to foster communication and research. The ground floor will provide pedestrian-oriented spaces such as retail, dining, and entertainment, with tree pools and plazas for the urban landscape. Temporary parking spaces and underground parking will be provided.

(11) Large Shopping Mall Buildings

Two large shopping malls, Tianhe New World and Yuan Yang Tianjiao Apartments, are located within the study area. These modern buildings are equipped with underground parking facilities. For these large-scale building zones, the original commercial, residential, and office functions will be retained. The ground floor will be optimized with seating, tree pools, and public squares to improve the landscape and public spaces.

(12) Special Zone

The special zone includes the Tianhe Passenger Station, located at the intersection of Tianyuan Road and the Guangzhou Ring Expressway. As a public transportation hub, this area will be optimized to enhance the city gateway's impression and improve pedestrian and vehicle facilities.

(13) Urban Village

Located west of Tianyuan Road, this area is currently a dense self-built housing zone. The design will maintain a residential focus with auxiliary services. The connection to urban roads will be improved, and the internal road network will be optimized. Some old buildings will be demolished to release space for urban public use. Retail, dining, and entertainment uses will be integrated into the ground floor, along with multiple pocket parks. A concentrated multi-level parking facility will be constructed.

(14) Military Zone

The military zone is considered a special area, and no design will be made for it in this planning.

5.5 Land Use Control

The morphological guidelines for land use control differ from traditional regulatory planning methods. Traditional planning divides residential, commercial, industrial, and public service facilities into separate zones, often resulting in isolated and chaotic spatial layouts. In contrast, the morphological guidelines adopt a "whitelist" approach to land use control, emphasizing functional mixing. This design prioritizes the principles of mixed use, compactness, and diverse functionality. The whitelist approach replaces functional zoning, allowing any of the listed functions—or a combination of them—to be established on a plot within the designated areas, under the specified conditions.

5.5.1 General Principles of Land Use Control

(1) Mixing of Functions

In alignment with the concept of integrated urban and industrial development, the design seeks to organically combine industrial and urban spaces. This breaks away from the traditional model of isolated, large-scale industrial parks. A single form zone can accommodate various functions, such as industrial office buildings, residential units, and commercial retail complexes, within the same space.

(2) Compactness

The design emphasizes the compact and high-density development of land. In the designated design area, there will be a layout that includes offices, residences, leisure, entertainment, and educational services, in preparation for the development of the Yuangang Science and Innovation Gateway.

(2) Diversity

The design retains a variety of functions to ensure diversity in land use. New development such as future science and technology innovation parks, small industrial parks, and other related functions will be introduced. Existing functions, such as the large garment industry park and logistics warehouses on the west side of the creek, will remain, ensuring continuity in the industrial structure. Additionally, the food wholesale market on the western side will continue, supplementing the industrial ecosystem and ensuring sustainable, long-term development. The open spaces within the design area will also be encouraged to host temporary activities and events.

5.5.2 Categories of Land Use

The design categorizes land use into six main groups, each of which will incorporate a variety of functions to meet the evolving needs of the area:

(1) Manufacturing and Processing, Warehousing and Distribution, Industrial Activities

This category will focus on accommodating manufacturing, processing, warehousing, and logistics operations. These functions are essential for supporting the regional economy and ensuring the area's industrial base remains competitive and integrated with urban functions.

(2) Residential

A mix of residential types will be provided in this category, including high-density residential buildings and more integrated residential-office combinations. This approach helps to create live-work environments that cater to the needs of both residents and businesses.

(3) Public Service Facilities

This category will include a variety of public services, including healthcare, education, and community centers. These services are designed to enhance the quality of life for residents and provide necessary amenities for the growing population in the area.

(4) Retail and Commercial

This category will focus on retail outlets, restaurants, entertainment venues, and other commercial uses. These spaces will be designed to serve both the local community and visitors, offering vibrant spaces for shopping, dining, and socializing.

(5) Commercial and Financial Services

The design will integrate commercial office spaces, financial institutions, and business services that cater to the needs of the regional economy. These spaces will be strategically placed to maximize accessibility and connectivity to both residential and industrial zones.

(6) Infrastructure

This category includes essential infrastructure such as transportation, utilities, and public amenities. Well-planned infrastructure will ensure that all areas within the design zone are efficiently serviced and supported, promoting sustainable growth.

By integrating these six functional categories within the design area, the land use strategy promotes a more dynamic, connected, and adaptable urban environment. The goal is to create a well-balanced ecosystem that fosters innovation, economic growth, and a high quality of life for all users.Corresponding to urban villages (VIC), residential communities (R), mixed rental and sale areas (RS), small factory and park areas (SF), science and technology innovation parks (SI-1), small industrial parks (SI-2), comprehensive service corridors (CS), large industrial parks (SI-3), waterfront commercial areas (WB), waterfront

parks (WP), large shopping buildings (L), and the 11th Middle District, the permission for the use is divided into three types: Permitted Use (P), Use-Permit Required (CUP), and Use not allowed (-). Please refer to Table 5-3 for details.

Table5- 3 Morphological Classification and Functional Control Table

(Source: drawn by the author)

	VIC	R	RS	SF	SI-1	SI-2	CS	SI-3	WB	WP	L
Manufacturing and Processing, Warehousing and Distribution, Industrial Activities											
Businesses open from midnight to 5 a.m.	CUP	-	-	P	P	CUP	CUP	CUP	CUP	-	-
Food wholesale	-	-	-	-	-	-	CUP	LUC	-	-	-
Print Publishing - Small Scale				P	P	P	P	P	-	-	-
Clothing Manufacturing - Light Processing	-	-	-	LUC	-	-	-	P	-	-	-
Logistics Warehousing - Outdoor	-	-	-	-	-	-	CUP	P	-	-	-
Logistics Distribution Center - Indoor	CUP	-	-	P	-	-	P	-	-	-	-
Express Delivery Station	p	p	P	P	P	P	P	P	P	-	P
laboratory	-	-	-	-	LUC	-	CUP	CUP	-	-	-
Office, seminar room	-	-	LUC	P	P	P	P	P	-	-	P
Residential											
commercial residential building	LUC	P	P	LUC	-	LUC	P	-	-	-	-
long-term rental apartment	P	-	P	P	-	P	P	P	-	-	-
Office dormitory	P	P	P	P	-	P	P	P	-	-	-
nursing home	P	P	P	-	-	-	-	-	-	-	-
Public Service Facilities											
community activity	P	P	P	-	-	P	P	P	-	-	-
fitness facility	P	P	P	P	P	P	P	-	P	-	P
Kindergarten/School	P	P	-	P	-	-	CUP	-	-	-	
School	P	P	-	P	-	-		-	-	-	-
Art/dance studios, learning training centers, etc.	CUP	CUP	P	-	-	P	CUP	-	-	-	-
Clinic, health center	P	P	P	P	P	P	P	P	-	-	-
Library, reading room	P	P	P	P	P	P	P	P	P	-	-
Retail and Commercial											
Bars, pubs, livehouses	CUP	CUP	P	CUP	CUP	CUP	CUP	CUP	CUP	-	CUP
Internet cafes, billiard halls, board games, private cinemas	CUP	P	P	P	-	P	CUP	-	-	-	P
Beauty salons, hair salons, nail salons	P	P	P	P	-	P	P	-	-	-	P
Vegetable market, fresh food sales	P	P	LUC	-	-	-	CUP	LUC	-	-	-

dining places	P	P	P	P	P	P	P	P	P	P	P
General retail (excluding the following 3 characteristics)	P	P	P	P	P	P	P	P	P	P	P
Auto repair and parts sales	-	-	-	LUC	-	LUC	CUP	LUC	-	-	-
Electric bike repair and spare parts sales	P	P	-	P	-	P	P	P	-	-	-
The operating hours are from 12:00 a.m. to 7:00 a.m.	-	-	-	P	-	P	CUP	P	-	-	-
Commercial and Financial Services											
hotel	P	-	P	P	P	P	P	P	-	-	-
Banquet catering	CUP	-	CUP	-	-	-	P	-	P	-	P
Bank	P	P	P	-	p	-	P	-	p	-	p
Industrial consulting services	-	-	-	-	p	p	P	-	-	-	p
Short-term rental apartments, youth hostels	p	p	p	-	-	p	P	p	-	-	p
Infrastructure											
Public Parking	p	p	p	p	p	p	P	p	p	p	p
Bus terminal (start and end station)	p	-	-	p	-	-	CUP	p	-	p	-
transformer substation	-	-	-	p	-	-	CUP	-	-	p	-

P Permitted Use; CUP Use-Permit Required; - Use not allowed

Note: There are a total of 15 form districts within the study area. This table lists the functional control requirements for 12 morphological divisions other than the higher education institution area, the special building area (Tianhe Railway Station), and the military area.

The function of the higher education institution area is mainly for teaching and living, and it is equipped with retail commercial facilities, sports stadiums, and other service facilities. The entire area is a campus area mainly focused on teaching, and it is a relatively enclosed spatial area with independent administrative management. Therefore, it is not listed in the table. Tianhe Railway Station, as a special passenger transportation hub, mainly functions for the gathering and distribution of people and vehicles, and is not within the scope of this design. Therefore, it is not listed in this table. The military area is a single-function and independent administrative unit, and therefore is not listed in this table

5.6 Summary of The Chapter

This chapter serves as a critical bridge from the macro vision to the specific spatial design, systematically establishing the overall framework and strategic system for the urban renewal of the Yuangang area. It provides clear guidance and a foundation for the subsequent detailed design of spatial zoning.

Firstly, this chapter defines the overall design vision centered on "innovation-driven, integration of industry and city" and sets implementation goals in two stages (near-term 2025-2028 and long-term 2029-2035). Based on this, five core design principles are proposed: innovation leadership, ecological priority, human-centered service, traffic optimization, and flexible growth. These principles ensure the forward-thinking, scientific, and implementable nature of the planning, aiming to transform Yuangang into a livable and business-friendly innovation district.

Secondly, the chapter outlines a detailed zoning update strategy. From the entire area to specific form districts (such as urban villages, residential neighborhoods, and various industrial parks), targeted methods and strategies are proposed for each zone. Overall, the plan emphasizes using Yuangang North Street as a comprehensive service corridor, strengthening the east-west transportation connections, maximizing the ecological value of Shahe Canal, and building a five-minute living circle. The resulting spatial strategy is “axis-guided, ecological permeation, and functional integration.”

Thirdly, this chapter provides an overall road and traffic design. The planning prioritizes "connectivity and the integrity of the road network structure" by constructing and optimizing roads to establish a clear hierarchical system of "main urban roads – secondary roads – local roads – community streets." The design respects the existing conditions and incorporates the pedestrian-friendly concept of “small blocks, dense road networks.” Specific guidelines for road updates in different zones are presented, aiming to enhance the accessibility and walking experience throughout the area.

Additionally, this chapter introduces an innovative form district planning method. Different from traditional functional zoning, this method is based on development intensity and spatial form. It defines 14 form districts within the study area and provides specific spatial construction requirements for 10 of these zones. This approach effectively avoids functional segregation and encourages functional mixing and attractive spatial connections, laying the foundation for the creation of a vibrant and diverse urban space.

Finally, the chapter establishes a flexible and mixed-use regulatory system. By replacing

traditional single-use zoning with a "white list of permitted uses," the planning emphasizes the mixed, intensive, and diverse nature of land use. Through three types of regulation—Permitted (P), Conditional Use Permitted (CUP), and Prohibited (-)—the various activities within each form district are managed in a more detailed manner, providing institutional support for achieving true industry-city integration and sustainable development.

In summary, Chapter 5 integrates vision principles, spatial strategies, traffic planning, form District, and land-use regulations to construct a comprehensive, coordinated, and flexible overall scheme. It lays a solid planning foundation for the detailed spatial design and implementation of the Yuangang innovation gateway.

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Chapter 6:Form-Based District and Spatial Elements Design Guidelines

6.1 Form District Design Guidelines

Based on the requirements of each form district as specified in the morphological control planning,this section provides illustrative design for the different districts within the design scope,plans for the spatial nodes covered,and proposes requirements for spatial form construction.It offers guiding design demonstrations for open space forms, spatial activities,and spatial effects.



Figure6- 1 Controlling Illustrative Planning

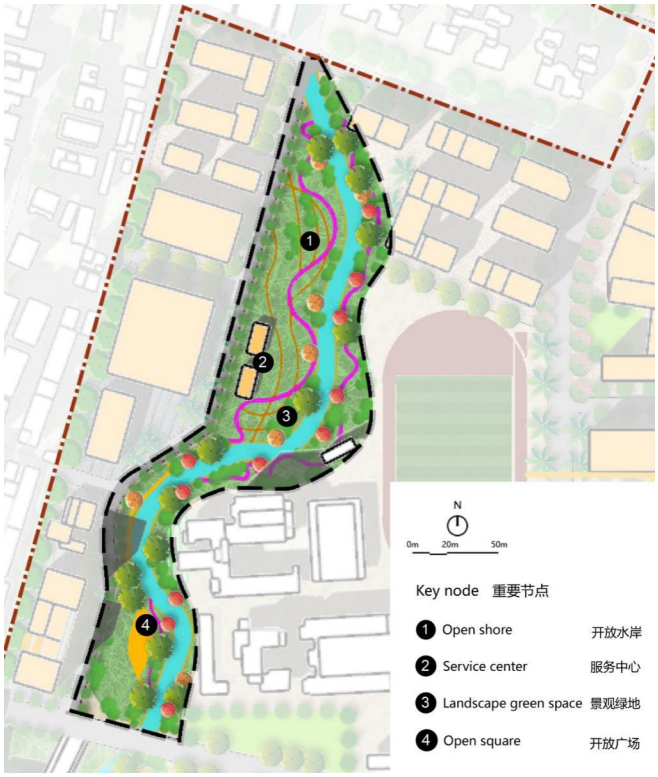
(Source:drawn by the author)

6.1.1 Riverside Corridor Park

（1）Design Vision

This area,as a river embankment,is a section of the Guangdong 10,000 Li Greenway.Strengthening the open waterfront landscape,providing the Yuan area with

medium-sized urban parks and green spaces,and enhancing the connection quality of the river embankment are important parts of improving open space quality.



(2)Design Strategy：

Enhance the quality of green spaces and river embankment areas.

Increase open green spaces,parks,squares, and similar areas.

Repair the spatial structure to connect the eastern and western sides of the river.

Construct walking tour paths to provide park and square spaces with comfortable service and good accessibility.

Figure6- 2 Plan of the Riverside Corridor Park

(Source:drawn by the author)

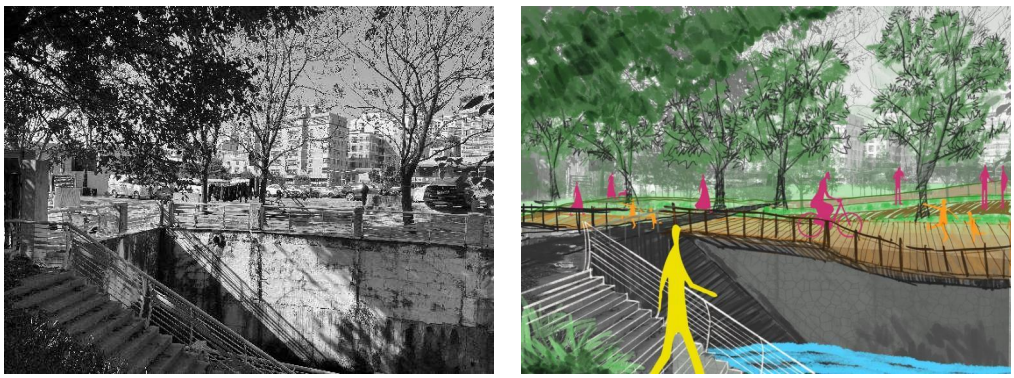


Figure6- 3 Schematic diagram of waterfront platform renovation

(Source:drawn by the author)

6.1.2 Residential communities

（1）Design vision

The newly built residential community area on the east side of the Swan Garden,the land is relocated from the large grain and oil wholesale market,to accommodate the population that will be absorbed by the future development of the Yuan Gang Science and Technology Gate for housing,or to provide as resettlement housing for the demolition of village-in-the-city.The irregular triangular plot on the east side is designed as a large community park.

（2）Design Strategy

Increase the construction of a new residential area,add one nine-year 36-class school.Introduce a large community park on the east side.

Repair the spatial structure,connect Zhong Cheng Road and Yuan Gang North Street.

Incorporate group green spaces,create walkable street spaces,establish pedestrian tour routes,and provide parks and square spaces that are comfortable and easily accessible.



Figure6- 4Floor Plan of Residential Area

(Source:drawn by the author)

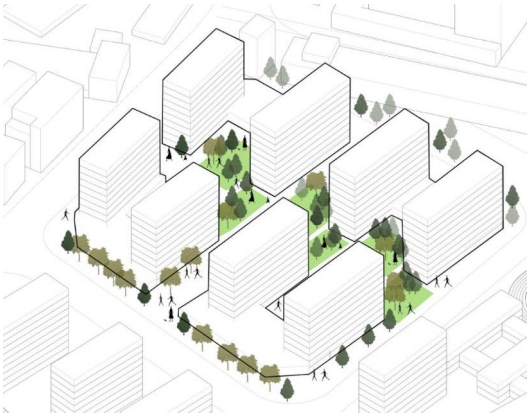


Figure6- 5 Axonometric Drawing of Residential Area

(Source:drawn by the author)



Figure6- 6 Schematic Diagram of Residential Area Renovation

(Source:drawn by the author)

6.1.3 Science and Technology Innovation Industrial Area

（1）Design Vision

After the demolition of factories in the eastern part of Guangzhou Construction Vocational College,land will be provided for the science and technology innovation industrial area,and it will serve as a basis for the division of the western road. The science and technology innovation industrial area will be developed into a district with beautiful environment and

appropriate density.It will integrate multiple functions such as R&D,incubation,office,and retailcommerce into an innovative area.In the future,it will ttract enterprises in innovative manufacturing,network technology,and other fields. This area will provide these medium-sized enterprises with complete office facilities and commercial service facilities. Spatially,it emphasizes openness and sharing,forming good connections with surrounding residential communities and other areas.



Figure6- 7 Floor Plan of Science and Technology Industrial Entrepreneurship Area (Source:drawn by the author)

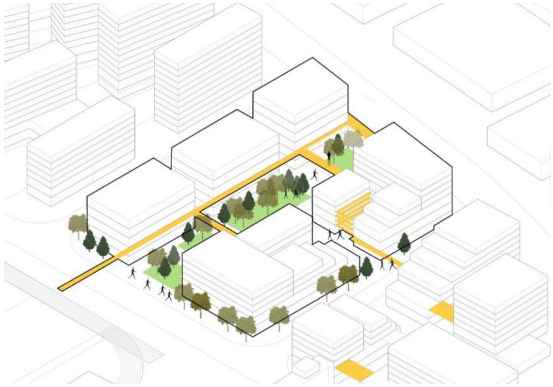


Figure6- 9 Axonometric view (Source:drawn by the author)

(2)Design Strategy

Design sufficient landscape green spaces to enhance spatial quality.

Construct multi-layered public systems including open squares, green spaces,walkways,terraces, etc.

The ground floor interface considers commercial podiums, providing commercial services for both the area and its surroundings.

Focus on the design of shared spaces such as meeting rooms, multimedia rooms,cafes,and other public spaces,offering opportunities for interaction and innovation for the tech and innovation community.



Figure6- 8 Conceptual view

6.1.4 Industrial Park

This area also provides support for future industrial development,continuing the existing small-scale industrial park building clusters in the south in terms of spatial form,emphasizing functional compatibility.The area primarily serves small and medium-sized enterprises,while also providing nearby residential functions such as apartments and concentrated housing for workers,as well as retail functions.Additionally,the area retains original land uses such as logistics warehousing and small workshops.



Figure6- 10 Plan of a small industrial park

(Source:drawn by the author)

(2)Design Strategy

Design sufficient landscape green spaces and pocket parks to provide recreational areas.

Architectural design considers multi-level public systems such as walkways and terraces.

The community service center in the design cluster provides public activity spaces.The ground floor interface maintains continuity.It can serve as a commercial podium,providing commercial services both within and outside the area.

It offers various living spaces such as apartments,hotels,hostels,etc.

It emphasizes the design of leisure spaces and shared spaces,such as cafes,gyms,and other public spaces,providing opportunities for interaction among entrepreneurs.



Figure6- 11 Axonometric view of the small industrial park
(Source:drawn by the author)



Figure6- 12 Transformation schematic of the small industrial park
(Source:drawn by the author)

6.1.5 Mixed Rental and Sales Zone

(1)Design Vision

This area is located north of Guangzhou Vocational College of Construction,primarily providing various forms of residential services.It includes integrated rental and sales apartments,residential communities,commercial hotels, hostels,and more.It serves people working nearby.At the same time,it considers the potential for future long-term resettlement housing in the event of urban village demolition.



Figure6- 13 Floor Plan of Mixed Rental and Sales Zone
(Source:drawn by the author)

(2)Design Strategy

Design sufficient landscape green spaces to provide high-quality living.

Architectural design considers visual aspects,the connection with riverside green spaces along pedestrian paths,and expands the landscape view.

Design commercial podiums to provide commercial services for both within and outside the area.

Provide various living spaces such as apartments,hotels,and hostels.

Focus on the design of leisure and shared spaces,such as coffee shops,gyms,and other public spaces,to meet the leisure and social needs of different groups.



Figure6- 14 Axonometric view of the mixed rental and sale area

(Source:drawn by the author)



Figure6- 15 Schematic diagram of the transformation of the mixed rental and sale area

(Source:drawn by the author)

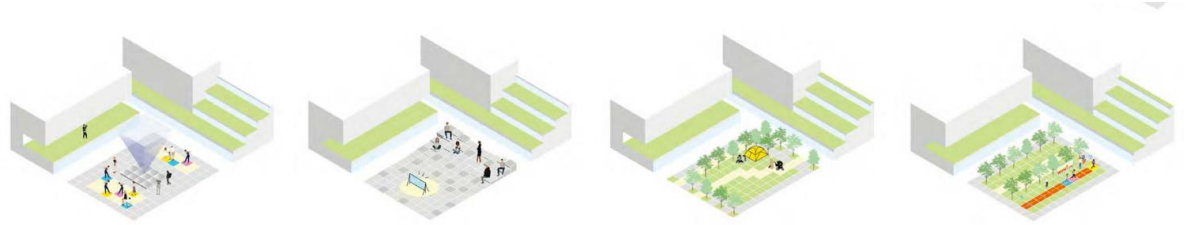


Figure6- 16 Activity schematic of the first-floor plaza

(Source:Internet)

6.1.6 Waterfront Commercial Area

（1）Design Vision

Located on the east side of the New Baihua Large-Scale Apparel Industrial Park.This design aims to transform thee large logistics warehousing facilities into waterfront commercial spaces,activating the spatial aesthetic value beyond the river ecology.It provides the entire area with a beautiful and environmentally friendly ecological commercial space,creating a multi-layered commercial street with various types of businesses such as dining,apparel retail,large supermarkets,and boutique stores.

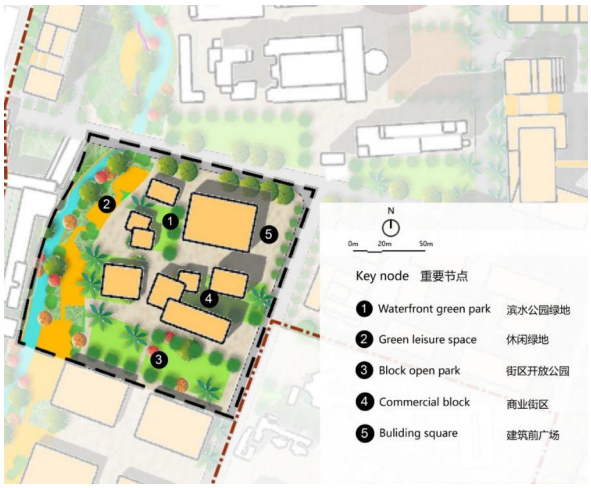


Figure6- 17 Plan of the riverside commercial area

(Source:drawn by the author)

(2)Design Strategy

The design employs scattered building volumes to liberate spaces such as ground-level streets and waterfront plaza green spaces,creating rich landscape layers. Flexible architectural forms interact with natural spaces.

Consider the permeability of the building facade.Focus on the design of leisure spaces and shared spaces,such as public areas like cafes and gyms,to meet the leisure and social needs of

different groups.



Axonometric view of the riverside commercial area

(Source:drawn by the author)



Figure6- 18 Conceptual illustration of the riverside commercial area

(Source:internet)

6.1.7 Large Industrial Parks

(1)Design Vision

This area is a large-scale clothing industrial park on the western side of the river channels.The design for this project involves the demolition of the eastern side,removing self-built factories and ancillary buildings,to release unbuilt space for the riverside coridor park.The existing factories will be renovated to provide land for roads,and additional residenti. units and office buildings will be added,offering possibilities for land resource allocation and spatial optimization to support industrial upgrading.The goal is to create a large-scale industrial park with functional compatibility.



Figure6- 19 Axonometric illustration of a large industrial park

(2)Design Strategy

Partially demolish the large factory buildings to create smaller building volumes.

Set up open spaces in front of the buildings to provide space for cargo loading,unloading,and transportation.

Flexible architectural forms interact with natural spaces.

Consider the interaction between the building interface viewing gallery and the landscape park.

Increase commercial office spaces to form a complete industrial chain with the factory.

Provide residential spaces such as apartments to serve factory workers and residents in the village on the west side.



Figure6- 20 Axonometric illustration of a large industrial park





Figure6- 21 Renovation schematic of the Large in industrial park





Figure6- 22 Renovation schematic of the Large in industrial park

(Source:drawn by the author)

6.1.8 Comprehensive Service Corridor Area

(1)Design Vision

This section is the corridor area on both sides of the urban secondary road Yuan Gang North Street (New Construction). The design for this project aims to use the new road as a carrier to connect the north-south orientation of the site,by incorporating various types of buildings,pocket parks,and diverse functional uses on both sides of the road,thereby strengthening the continuous architectural interface and corridor spaces.



Figure6- 23 Plan view of the comprehensive service corridor area

(2)Design Strategy

Demolish the temporary structures of the existing grain and oil wholesale market,and partially demolish some large workshops to create smaller architectural volumes.

The new urban secondary road will enhance the north-south connection of the site and provide a foundation for high-quality street spaces.

Incorporate various forms of architecture to create a rich street interface.

Plant pocket parks,group green spaces,and other multi-level open green spaces.

Utilize the ground-floor commercial interface to activate the site's appeal and create street vitality.



Figure6- 24 Renovation schematic of Yuangang North Street

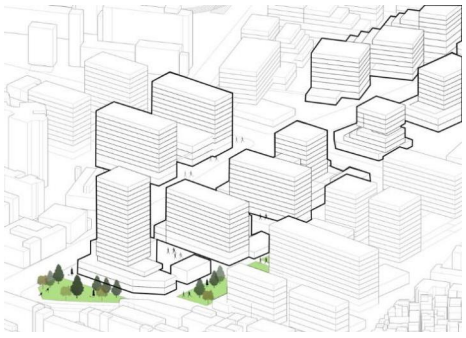


Figure6- 25 Schematic of the comprehensive service corridor area corridor

(Source:drawn by the author)

6.1.9 Bird's-eye view of the overall effect



图 6- 1 Bird's-eye view of the overall effect
(Source:drawn by the author)

6.2 Building type guidelines

This guideline proposes a reference for permissible building types within the design scope of the Meta-Gang Innovation Portal District. Some of these building types are derived from the extraction and optimization of types across the entire research area. They are categorized by form and provide a selection of building types, offering diverse options to guide the next level of specific architectural design.

6.2.1 Building Type Zoning

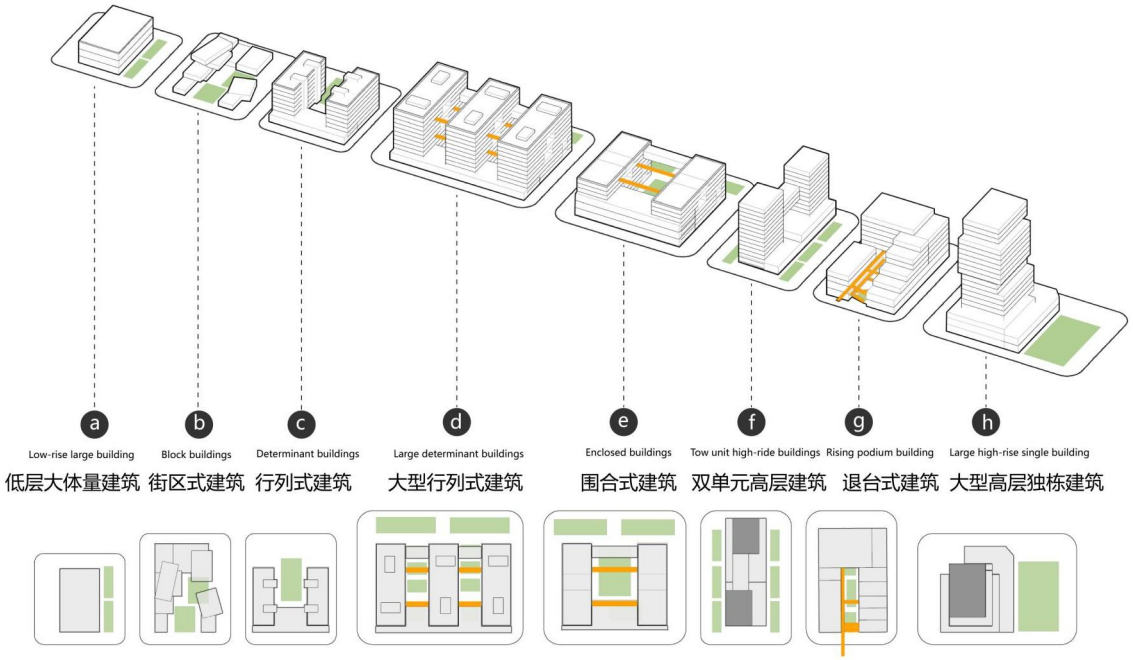


Figure6- 26 Schematic Diagram of Building Types

(Source:drawn by the author)

Based on the eight types of buildings proposed within the design scope,these buildings are arranged by intensity, ranging from low-intensity (low-rise large-volume buildings)to high-intensity (large standalone buildings).Each zone allows the selection of individual building types or groups from the following table for specific design,while also meeting the requirements for specific indicators in the subsequent tables for different types of buildings.

Table6- 1 Schematic Diagram of Building Type Zoning

(Source:drawn by the author)

	R	RS	SF	SI-1	SI-2	SI-3	WB	WP
Low-rise Mass Building	-	-	Y	-	-	-	-	-
Neighborhood-style Building	Y	Y					Y	Y
Row-style Building	Y	Y	Y	-	-	-	-	-
Large matrix-style architecture	-	Y	Y	Y	Y	Y	-	-

Enclosed architecture	-	-	Y	Y	Y	Y	-	-
Double-unit high-rise architecture	-	-	-	-	-	Y	-	-
Setback-style architecture	-	Y	-	Y	-	-	Y	-
Large high-rise single-building structure	-	-	-	Y	Y	-	-	-

Y=Alloed，construction permitted, - =Not Alloed，construction not permitted

6.2.2 Low-rise large-volume buildings

(1)Design guidelines

- Low-rise buildings with a large volume,typically 1-4 stories tall.
- Functionallyemphasizes compatibility,can be used for logistics warehousing,production workshops,and other functions.
- On the street-facing side,consider the space required for goods stacking;the open land on the non-street-facing side can be designed as a parking lot to accommodate both passenger and cargo vehicles.
- Small green spaces can be arranged along the side of the building.

(2)Design Indicator Diagram

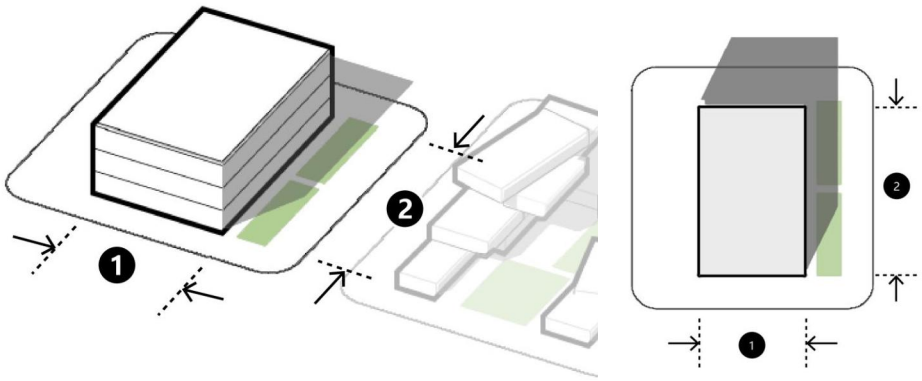


Figure6- 27 Schematic Diagram of Large-Scale Buildings

(Source:drawn by the author)

Control the span and depth of large-scale buildings to ensure that large-scale buildings meet production,storage, and other needs during renovation or new construction,while maintaining a continuous and unified urban character through reference intentions.Specific indicator controls are shown in the following table:

Table6- 2 Control Indicators for Large-Scale Buildings

(Source:drawn by the author)

	Maximum value(m)	Minimum value(m)	Reference intention
1.Depth	30	20	
2.Bay	75	50	
Building height	18	5	

6.2.3 Block-style architecture

- A cluster of street-oriented buildings with a height of 2-4 floors, without restrictive

requirements on bay width and depth. However, it should ensure a fragmented building mass, ample ground-level open space, green space, pedestrian space, and barrier-free design.

- This type of building primarily appears in waterfront commercial areas, community service centers in residential districts, nursing homes, and similar facilities.

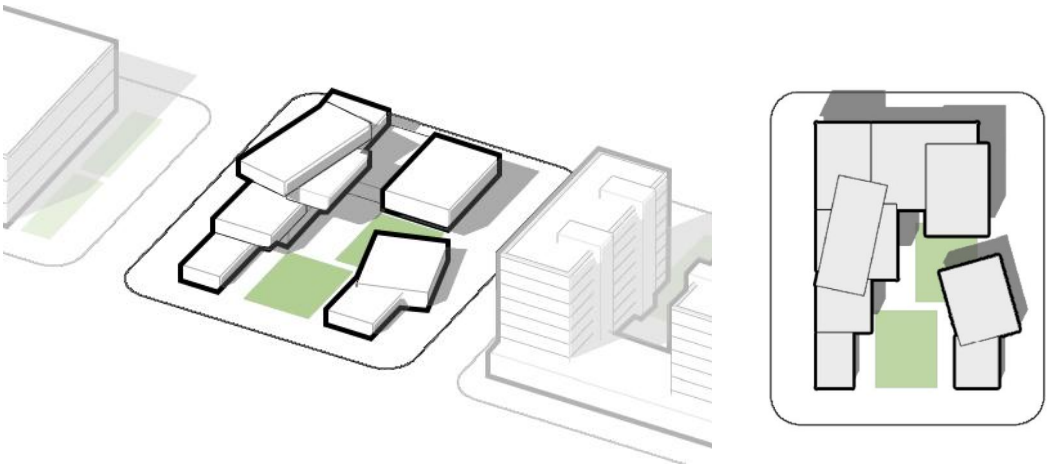


Figure6- 28 Schematic of block-style architecture

(Source:drawn by the author)

6.2.4 Grid-Style Architecture

(1)Design guidelines

- Cluster of row buildings with a height of 5-7 floors.
- This type of building is primarily used for residential purposes and must meet design requirements for natural lighting and ventilation, as well as fire safety standards. Emphasis is placed on compatibility in the vertical direction, with the ground floor and first floor potentially serving commercial or service functions.
- The ground area on the non-street-facing side of the buildings can be designed as parking spaces to accommodate cars. A centralized large underground parking garage should also be provided as part of the design.
- Small green spaces should be arranged between building clusters to provide ample landscape areas.

(2)Design Indicator Diagram

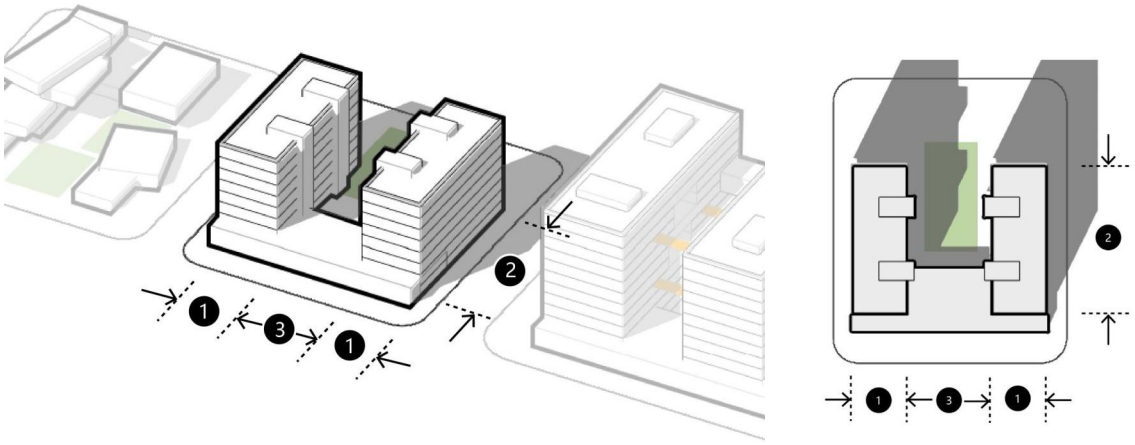


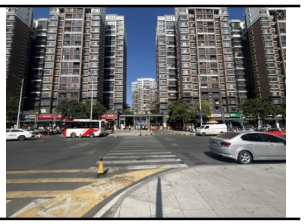
Figure6- 29 Perspective view of grid-like buildings

(Source:drawn by the author)

Control the span and depth of grid-like buildings to ensure that they meet the needs of sunlight and other requirements during renovation or new construction,while also forming a continuous and unified urban character through reference intentions.Specific indicator controls are shown in the following table:

Table6- 3 Control Indicators for Grid-like Buildings

(Source:drawn by the author)

	Maximum value(m)	Minimum value(m)	Reference intention
1.Depth	10	18	
2.Bay	20	45	
3.Building spacing	Determined based on the solar spacing, it is typically 1.2 times the building height.		
Building height	26m	-	

6.2.5 Large Grid Buildings

- A cluster of row-style buildings with a height of 6-8 floors, featuring larger depths, bays, and volumes compared to typical row-style buildings.
- This type of building has broader functional applicability, suitable for use as apartments, industrial offices, etc. Emphasis is placed on vertical compatibility, with the ground floor and second floor potentially serving commercial services or similar functions.
- The ground area on the non-street-facing side of the buildings and the spaces between building clusters can be designed as parking lots to accommodate car parking. Alternatively, a centralized large underground parking garage can also be considered.
- Small green spaces should be arranged between building clusters to provide ample landscape areas.
- Vertically, considerations can be given to designing skywalks, terraces, or other elevated

spaces to create a rich vertical spatial hierarchy.

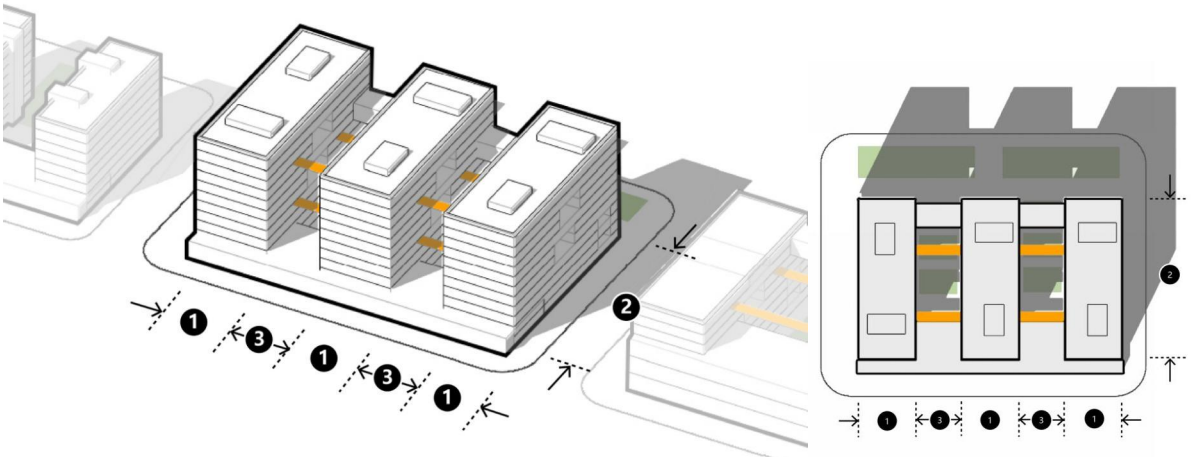


Figure6- 30 Schematic diagram of large linear buildings

(Source:drawn by the author)

Table6- 4 Large Matrix Building Control Indicators

(Source:drawn by the author)

	Maximum value(m)	Minimum value(m)	Reference intention
1.Building depth	10	18	
2.Building span	20	45	
3.Building spacing	Based on the specific building function: If used for residential purposes, the spacing is determined by the sunlight distance, with a minimum value typically being 1.2 times the building height. If used for other functions, the minimum distance is 10 meters.		

6.2.6 Enclosed Buildings

- Cluster of row buildings with a height of 5-7 floors.
- This type of building also has a wide range of applicable functions, suitable for use as apartments, industrial offices, etc. Emphasis is placed on vertical compatibility, with the ground and first floors' podium areas serving public activities and other functions.
- The ground level on the non-street-facing side of the buildings and the spaces between building clusters can be designed as parking areas to accommodate cars. Small green spaces should be arranged between building clusters to provide ample landscape areas.
- Vertically, considerations can be given to designing skywalks, terraces, or other elevated spaces to create a rich vertical spatial hierarchy.

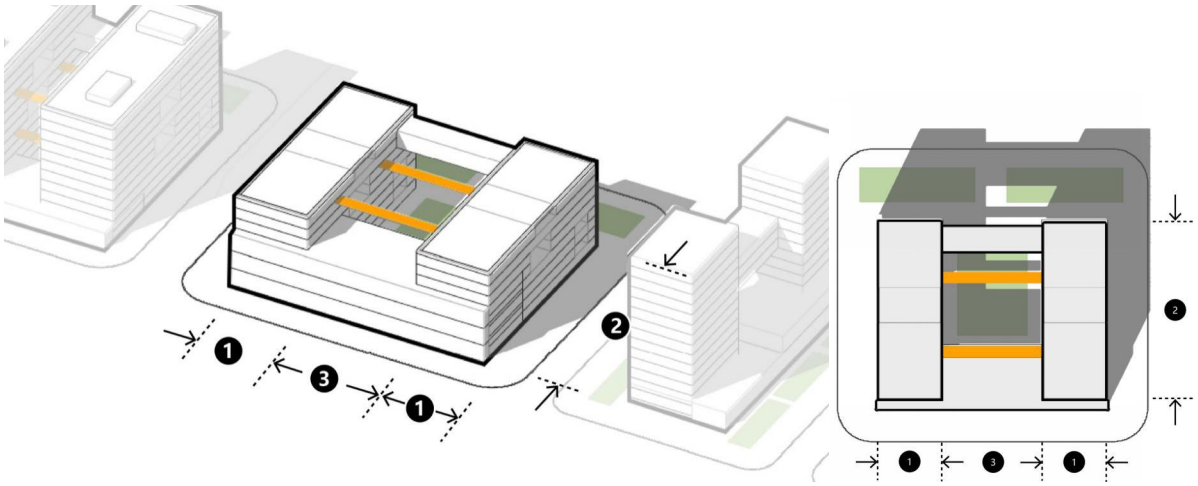


Figure6- 31 Enclosed building illustration

(Source:drawn by the author)

Control the span and depth of the double-unit high-rise building to ensure that the building volume matches the existing built environment during new construction.At the same time,ensure continuity and unity in the urban landscape through reference methods.Specific indicator controls are shown in the table below:

Table6- 5 Enclosed building control indicators

(Source:drawn by the author)

	Maximum value(m)	Minimum value(m)	Reference intention
1.Building depth	30	15	
2.Building span	35	65	
3.Building spacing	According to the specific building function: If used for residential purposes, the spacing is determined based on sunlight exposure, typically 1.2 times the building height. If used for other functions, the minimum spacing is 18 meters.		

6.2.7 Double-unit high-rise building

- A building cluster consisting of two high-rise unit buildings with a height of 12-15 floors.
- This type of building has broad functional applicability, suitable for use as industrial offices, apartments, etc. Emphasis is placed on vertical compatibility, with the ground and first floors' podium areas available for commercial services, public activities, and other functions.
- The non-street-facing ground area and the space between building clusters can be designed as parking lots to accommodate car parking. A large underground parking garage should be provided as part of the facilities.
- Small green spaces and pocket parks should be arranged between building clusters to provide ample landscape areas.

- Vertically, considerations can be given to designing skywalks, platform spaces, or other elevated areas to create a rich vertical spatial hierarchy.

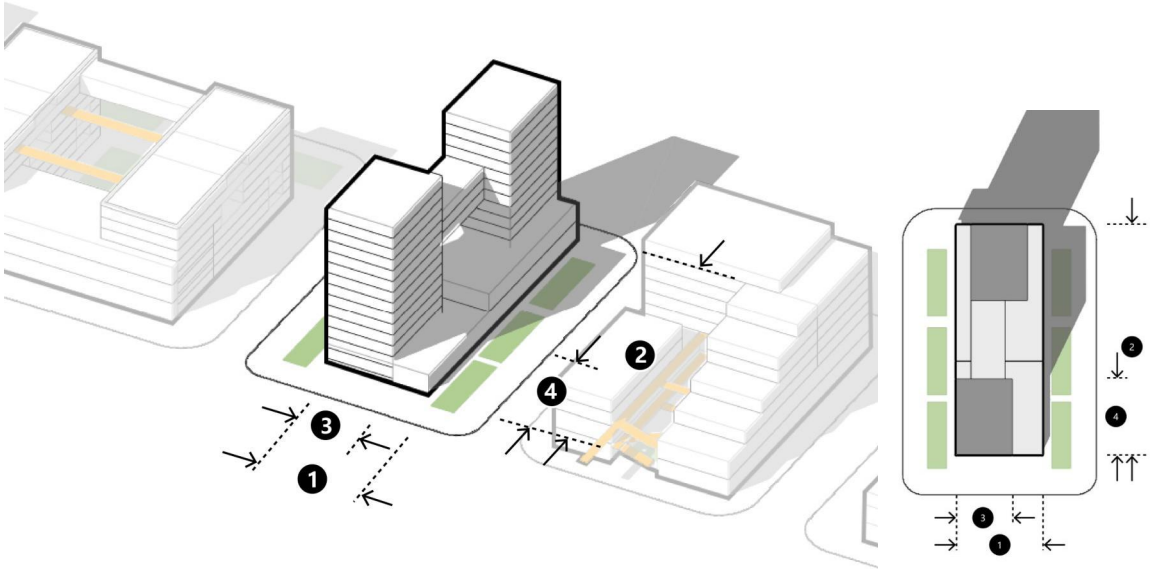


Figure6- 32 Schematic of a double-unit high-rise building

(Source:drawn by the author)

Control the span and depth of the double-unit high-rise building to ensure that the building volume matches the existing built environment during new construction.At the same time,ensure continuity and unity in the urban landscape through reference methods.Specific indicator controls are shown in the table below:

Table6- 6 Double-Unit High-Rise Control Indicators(Source:drawn by the author)

	Maximum value(m)	Minimum value(m)	Reference intention
1.Depth of the skirt room	30	15	
2.Building Depth	22	16	
3.Skirt building bay width	65	-	
4.High-rise building bay width	28	-	
Building height	50		

6.2.8 Setback Building

- A setback-style building with a height of 8-10 floors.
- This type of building is primarily used for industrial office purposes and must meet design requirements for daylighting and ventilation. Emphasis is placed on functional compatibility in the vertical direction, with the first and second floors potentially serving as commercial services, such as convenience stores and cafes.
- The ground level on the non-street-facing side of the building can be designed as a parking area to accommodate car parking. A large underground parking garage should

also be provided as part of the design.

- Small green spaces should be arranged between building clusters to provide ample landscape areas.
- The setback portions can be utilized as terraces or platforms for public activities, connected by skywalks and staircases to create a rich spatial hierarchy

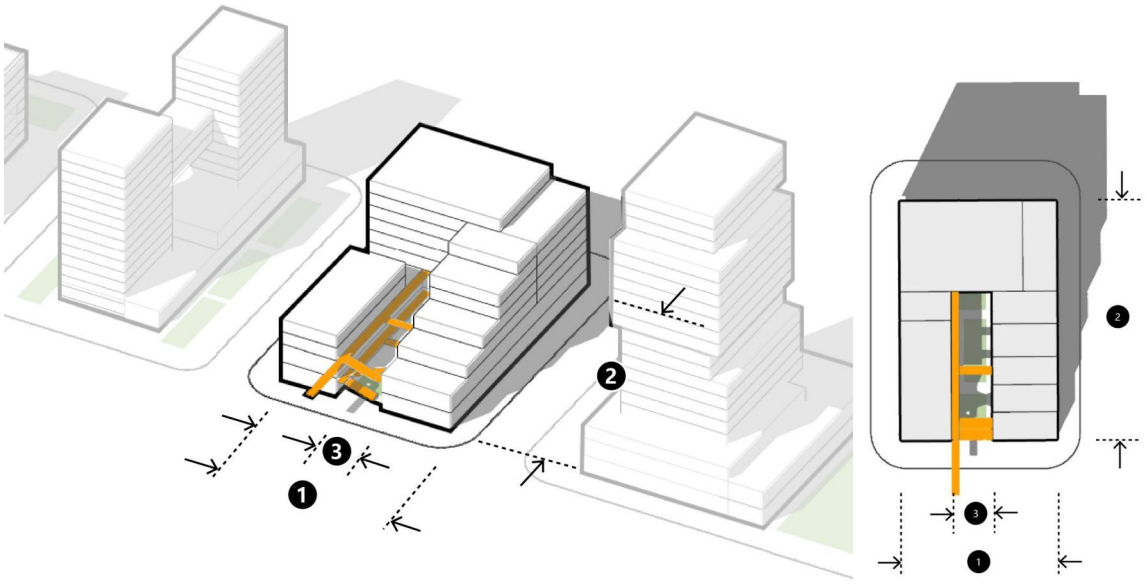


Figure6- 33 Schematic Diagram of Terraced Buildings

(Source:drawn by the author)

Control the span and depth of terraced buildings to ensure that the building volume matches the existing built environment when new construction occurs.Additionally,through reference to design intent,maintain a continuous and unified character in the urban landscape.Specific indicator controls are detailed in the following table：

Table6- 7 Retractable Building Control Indicators

(Source:drawn by the author)

	Maximum value(m)	Minimum value(m)	Reference intention
1.Depth of podium	30	15	
2.Depth of high-rise section	15	65	
3.Width of internal courtyard	-	8	
Building height	34m	-	

6.2.9 Large High-rise Single-building Structures

- Large high-rise monolithic buildings of 20-22 storeys.
- This type of building is mainly used for industrial office functions, with emphasis on functional compatibility in the vertical direction, and the first to fourth floors can be used

for commercial facilities such as large shopping malls.

- The ground floor of the non-street side of the building can be designed as a car park to ensure car parking. A centralised large underground car park should be designed.
- Green space or plaza should be designed in front of the building to provide pedestrian circulation and other functions, and can be used as a community pocket park at the same time.

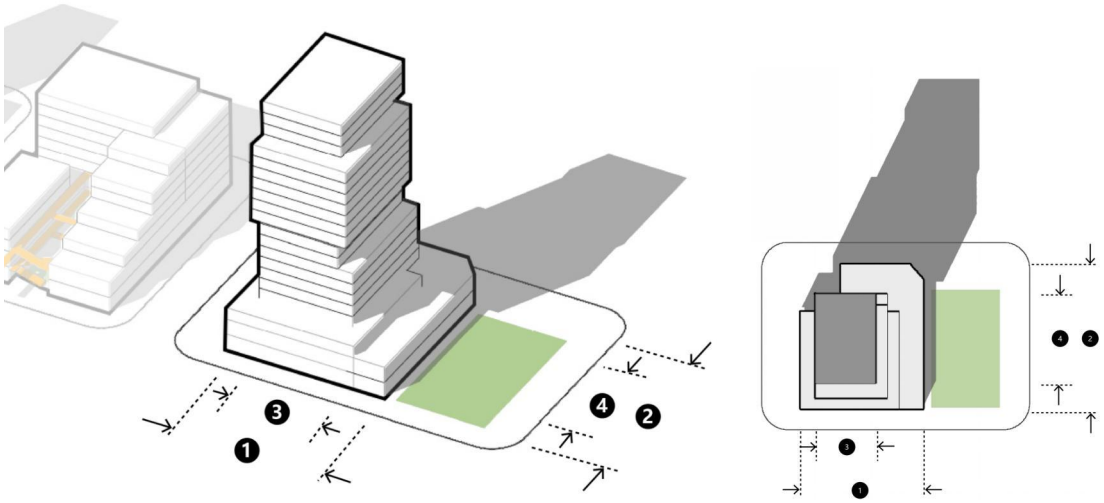


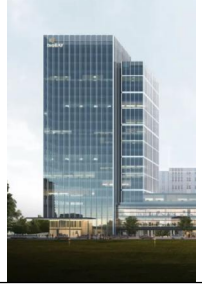
Figure6- 34 Schematic of a large high-rise standalone building

(Source:drawn by the author)

Control the bay width and depth of high-rise standalone buildings to ensure the uniqueness of the building volume during new construction.Consider them as landmark buildings for the area,ensuring compatibility with the existing built environment.At the same time,through reference methods,ensure a continuous and unified character in the urban landscape.Specific indicator controls are shown in the following table:

Table6- 8 Control Indicators for Large High-rise Single-family Buildings

(Source:drawn by the author)

	Maximum value(m)	Minimum value(m)	Reference intention
1.Depth of podium	50	15	
2.Podium opening	15	65	
3.Tower depth	30	20	
4.Tower opening	45	25	
Building height	70m		

6.3 Design guidelines

The overall road design specifies the principles of road design as connectivity and structural integrity of the road network. This design improves the road hierarchy system of urban main, secondary and branch roads. It also supplements the streets in the district, and constructs the urban road structure system of urban main roads - urban secondary roads - urban branch roads - community streets, as shown in Fig. 6-35, so as to facilitate the district to internal roads and external roads for better connection.

This guideline proposes design guidance for the section of urban roads of the fourth level.

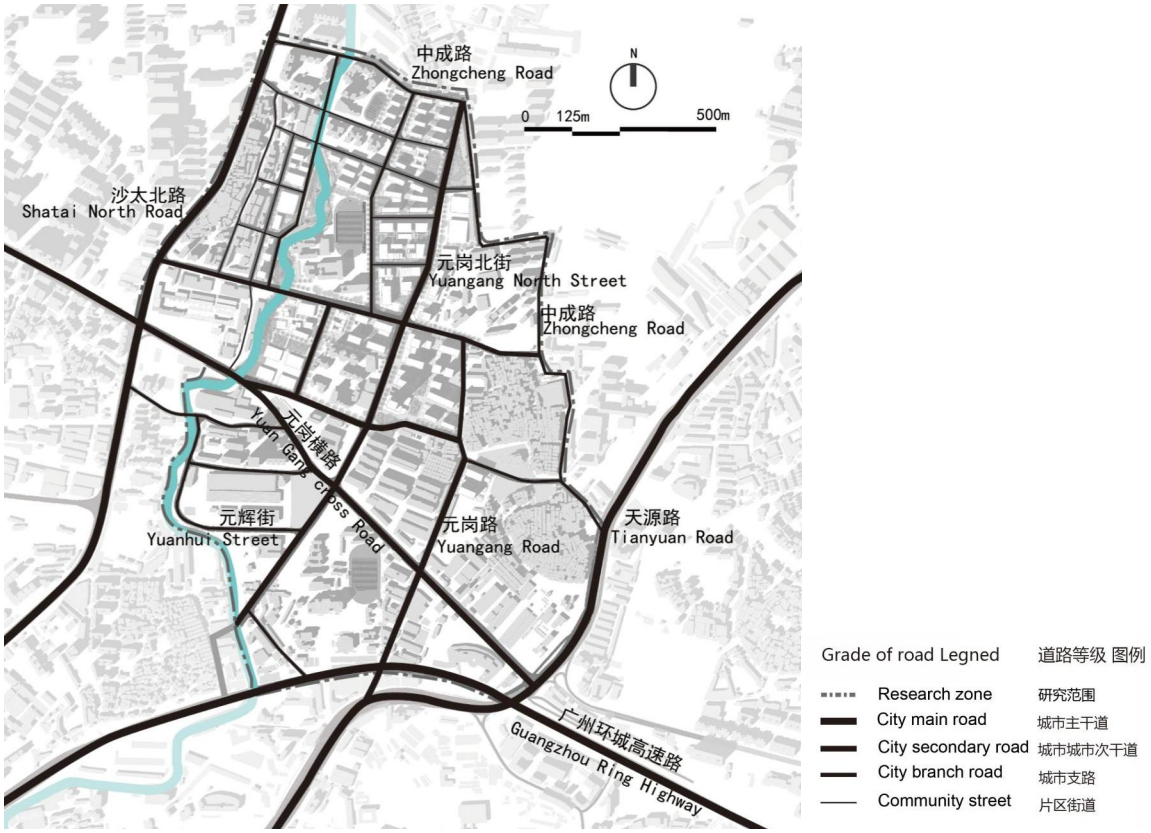


Figure6- 35 Road Classification Diagram

(Source:drawn by the author)

6.3.1 Road Classification Design Guidelines

(1)Urban main trunk roads

This design scope does not include urban main roads.The roads within the research scope,such as Shatai Middle Road,Shatai North Road,and Tianyuan Road,are of this type,typically dual carriageways with 8 or more lanes,prioritizing vehicle traffic needs.Motor vehicle lanes and non-motor vehicle lanes are not separated,and are not suitable for

pedestrian scales.

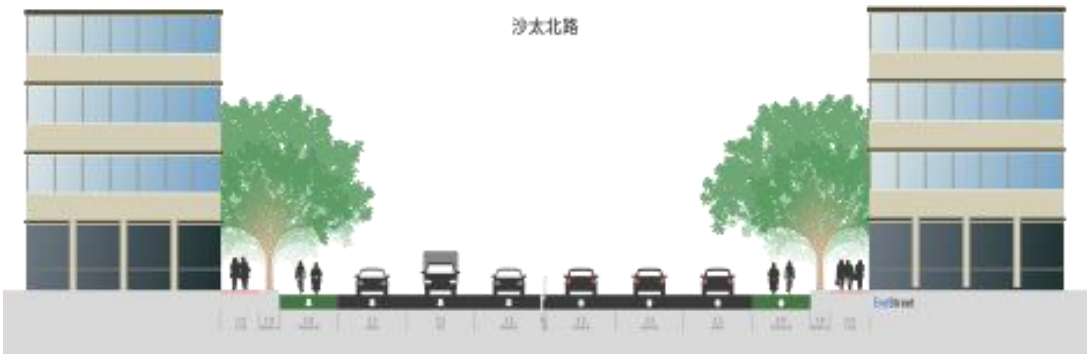


Figure6- 36 Schematic section view of an urban main road

(Source:drawn by the author)

(2)Urban secondary roads

- A new urban secondary arterial road within the design area, extending north-south from Yuan Gang North Street through the site.
- The secondary urban arterial road will be designed with a minimum of four lanes of motorised traffic in each direction and a median green belt.
- To ensure separation of motorised and non-motorised traffic, the use of a green belt for separation is recommended.
- Pavement width is at least 4m.
- Pay attention to the design of bus stops, canopies, seats and other facilities to ensure the safety of pedestrians and vehicles and make the walking experience smooth.



Figure6- 37 Cross-sectional view of urban secondary roads

(Source:drawn by the author)

(3)Urban branch roads

- Four new urban side streets within the design area.
- Urban secondary roads are designed with at least two lanes of motorised traffic in each direction and a central dividing green belt.
- Ensure the separation of motorised and non-motorised traffic, the use of green belts for separation is recommended.
- Pavement width of at least 4m.
- Pay attention to the design of street furniture such as bus stops, seats, etc., to ensure the convenience and smoothness of the walking experience.



Figure6- 38 Cross-section of an urban branch road

(Source:drawn by the author)

(4)Community Streets

- Within the design area, a number of new neighbourhood streets will be built to connect urban side streets and secondary urban arterials, supplementing the structural hierarchy of the road network.
- Urban side streets are pedestrianised as a priority, ensuring two-way lanes for motor vehicles, and can be built without a central dividing green belt. Motorised and non-motorised lanes can be separated without a split.
- Pavement width is at least 3m.
- Pay attention to the design of streetscape amenities such as seating and plants to ensure

the convenience and comfort of the walking experience.



Figure6- 39 Cross-sectional view of a community street

(Source:drawn by the author)

6.3.2 Street landscape Design guidelines

In addition to their traffic functions,streets are important open spaces,and the spatial quality of the street scene also determines the attractiveness of the place.The "Santa Ana Specific Plan"categorizes streets with different attributes and proposes corresponding design guidelines.This plan draws inspiration from this approach.

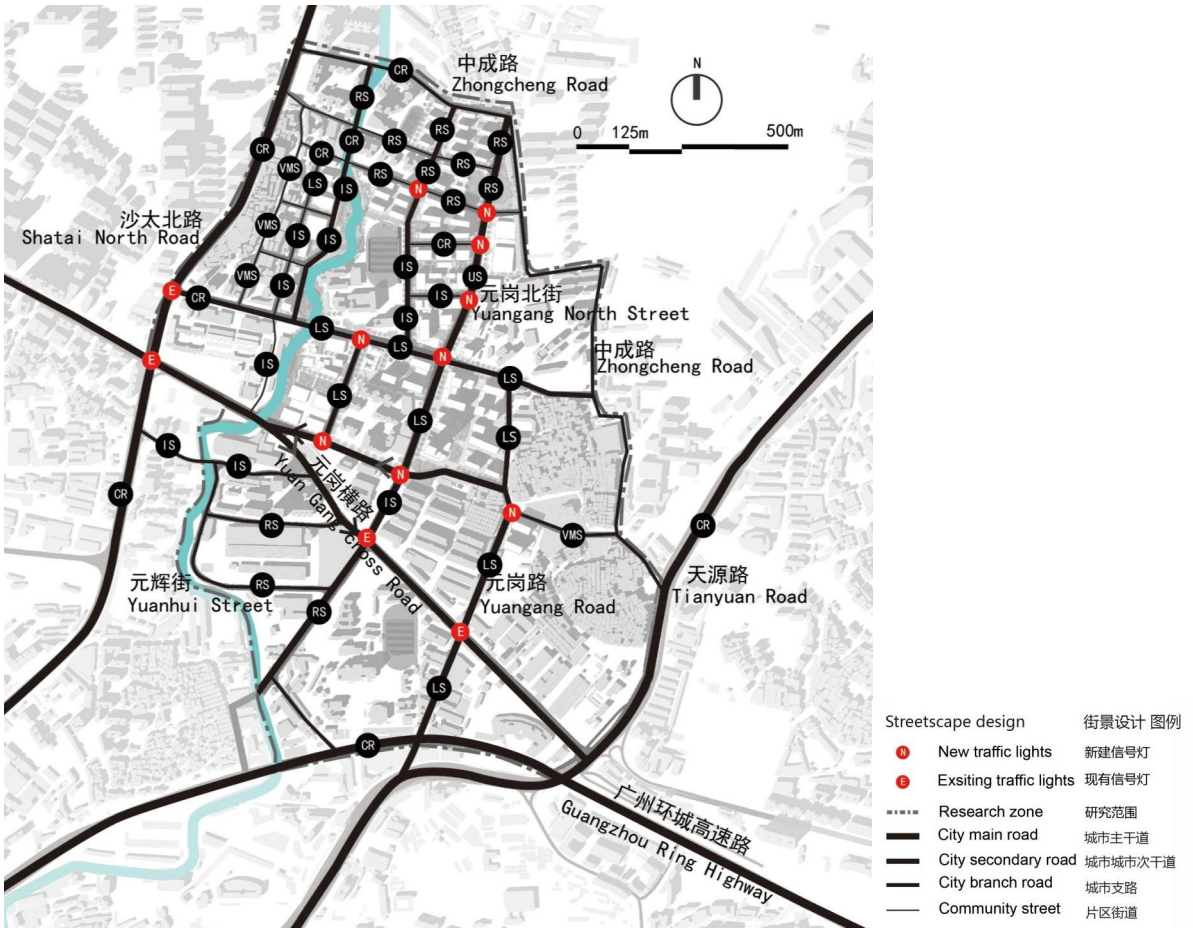


Figure6- 40 Diagram of Street Landscape Types

(Source:drawn by the author)

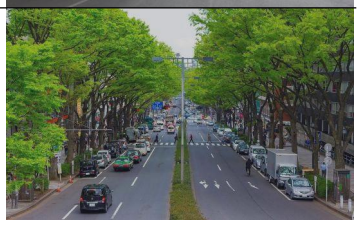
This overall has several strategies as follows:

- Overall emphasis on pedestrian-friendly street design.
- The travelling needs of pedestrians and bicycles are given due consideration. Dedicated non-motorised lanes are considered for each type of street, and the use of green belts for separation is recommended.
- Adequate pavement widths and streetscapes to enhance pedestrian comfort and street appeal.
- Consider the design of bus stops, seating, tree planters, and other landscape features for different streets.

- Shape the streetscape atmosphere for different types of streets.
- This design divides the road into five characteristic types of street space, which can be seen in the following table and the design reference illustration.

The distribution of each type of street can be seen in Figure 6-43.

表 6- 1 Street Landscape Type Table (Source:drawn by the author)

Street Name	Characteristic Description	Refer to the illustration
City Road	Six lanes or more in both directions,exceeding pedestrian scale.Primarily characterized by vehicle traffic, with pedestrian crossings at intervals of 200m-250m,or handled through the use of pedestrian overpasses. Main urban thoroughfare	
Urban Street	Dual two-lane,with bicycle lane.Motor vehicles and bicycles are separated. Lively pedestrian,non-motor vehicle,and vehicle roads,diverse street scenes,and multiple functional clusters allowed on both sides of the roads. City secondary roads	
Residential Street	Roads between residential community clusters are suitable for walking,with a quiet atmosphere and strong landscape focus,primarily considering green plantings, and allowing temporary motor vehicle parking. Urban collector road	
Village Main Mtreet	The main streets of village enclaves.Lively street scenes, considering mixed traffic of pedestrians and non-motorized vehicles,as well as parking for non-motorized vehicles. Urban collector road	This is not within the scope of this design.
Industiral Street	Roads between the Science and Technology Innovation Park and small industrial parks, with street scenes on both sides allowing mixed commercial activities,and temporary motor vehicle parking permitted.Design facilities such as benches and tree pits to provide possibilities for public interaction. Community streets	
Live Street	Streetscapes with strong mixed-use characteristics on both sides, where the internal functions of the adjacent plots are not restricted. Dedicated non-motorized lanes are provided, public transportation is encouraged, and recessed parking spaces are recommended. Pocket parks, seating areas, and other small public space clusters designed for people to linger are created. Community Street	

Note:This table is parallel to the road classification,indicating which type of street belongs to which level of road



Figure6- 41 Perspective view of production-type streets

(Source:drawn by the author)

6.4 Open Space Guidelines

The design of rich open spaces and green spaces is an important strategy in this project. This plan aims to leverage the landscape value of the Shahe River, activating its ecological and scenic attributes. At the same time, within a broader research scope, it intends to incorporate squares and green spaces to systematically enhance the quality of the spatial environment, providing an attraction for the future industrial transformation and development of the Yuangang area.



Figure6- 42 Open Space Planning Diagram

(Source:drawn by the author)

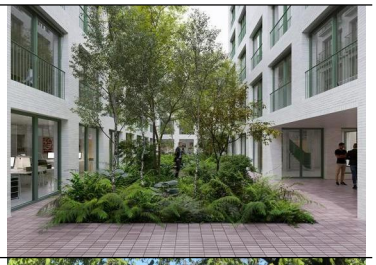
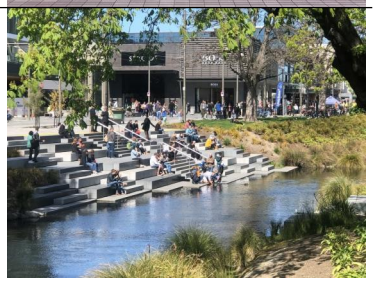
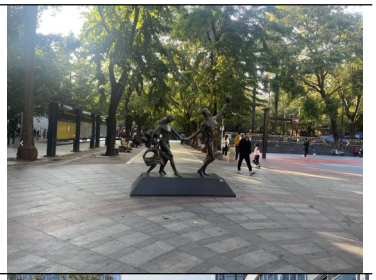
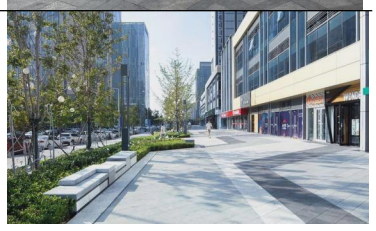
The overall strategies for this project are as follows:

- Maximize the utilization of the waterfront landscape. The waterfront corridor park is the most important park and green space in this design.
- Build a rich hierarchy of open spaces to serve the users of different zones.
- Different open spaces should be inclusive of various public activities.

This design classifies the roads into five types of street spaces with distinct characteristics.

Please refer to the table below for details and the design reference illustrations. The distribution of each type of street can be seen in Figure 6-45.

Table6- 9 Open Space Types Table (Source:drawn by the author)

Open Space Types	Feature Description	Reference intention
Waterfront Park:	Softening the hard interface of the river channel and enhancing its hydrophilicity. Openness: Open to all residents in the area and all residents in the city. Usage activities: Various activities such as leisure, strolling, sightseeing, cycling, and running.。	
Community Park Green Space	The large green space on the east side of the residential area is primarily characterized by plant and green landscape, with hard-surfaced paths serving as park trails. Accessibility: Open to all residents of the district and the entire city. Usage and Activities: Suitable for a variety of activities such as walking, sightseeing, gatherings, and leisure.	
Small Cluster Green Space	Green space between building clusters, with small plant groupings dominating the landscape and hard paving as park paths. Openness: open to people within the surrounding building groups. Usage activities: Recreation	
Riverside Public Plaza	The waterfront plaza in the southern section of Hechong, a large open hard square, can consider hydrophilic terrace design, with small plant group landscape, can be designed in large hard paving small green plants or green group. Openness: adjacent to the waterfront commercial area, open to all people in the city. Use activities: leisure, party, commercial bazaar, etc.	
Urban Village Square	A small open hard plaza in the urban plaza between Sheung and Shiang Yuan Gang, the waterfront plaza in the southern section of Hechong. Openness: located inside the urban village than adjacent to the waterfront commercial area, mainly for urban village residents. Usage activities: leisure, party, commercial bazaar, sports ground, etc.	
Building Front Plaza	Plaza in front of the commercial building, small open hard plaza, can design small green planting belt or green space group at the edge of the plaza. Openness: adjacent to large commercial buildings, open to all people in the city. Use activities: leisure, distribution, commercial bazaar, etc.	

6.6 Summary of The Chapter

As the implementation and refinement phase of the overall spatial design strategy, this chapter systematically formulates specific design guidelines for the Yuangang Science and Technology Gateway District, providing clear basis and standards for the next stage of detailed design.

First, through form district design guidelines, this chapter translates the macro-level planning vision into micro-level design directives for nine specific districts. Each district is assigned a distinct design vision and strategy, visualized through various means such as plan drawings, axonometric diagrams, and renderings. This ensures the spatial realization of diverse functions—from waterfront ecology and residential living to technological innovation and industrial upgrading—collectively forming a functionally integrated and organically interconnected urban district.

Second, this chapter establishes architectural typology guidelines, proposing eight building types suitable for different districts, with regulations on intensity, function, form, and specific control indicators. These guidelines aim to ensure both diversity and overall harmony in the architectural style of the district, providing a refined design framework for creating building spaces suitable for diverse human activities and stimulating innovative vitality.

Third, this chapter develops street design guidelines, refining the four-tier road system of "urban arterial roads–sub-arterial roads–branch roads–community streets," and innovatively defines six street landscape types based on the dual dimensions of "traffic attributes" and "spatial attributes." The guidelines prioritize pedestrian and bicycle accessibility, emphasizing street landscaping and facility design to transform roads from mere traffic channels into vibrant urban public spaces, enhancing the appeal and comfort of the area.

Finally, this chapter formulates open space guidelines, focusing on maximizing the ecological and landscape value of the Shahe River to create a multi-level, networked open space system. The guidelines clarify the characteristics and functions of various types of open spaces, from large waterfront parks and community green spaces to building front plazas, aiming to systematically improve the overall environmental quality, provide diverse public activity spaces for residents, and ultimately enhance the overall charm and sustainability of the Yuangang District.

In summary, the four sets of guidelines in this chapter together form a comprehensive and operable spatial design toolbox, ensuring design quality in the morphology, architecture, streets, and environment of the Yuangang area. This lays a solid foundation for transforming the planning blueprint into a high-quality built environment.

Summary and Outlook

1.Main Conclusions

This design adopts the method of Form-Based Codes (FBCs), reviewing the related theories of New Urbanism, the origin, evolution, and broad application of FBCs. Drawing on spatial control elements such as neighborhood, corridor, and special district, the study takes the Yuangang area as its case, using zoning, corridors, and the 5-minute living circle as key urban-scale form elements, and develops a systematic and comprehensive set of design outcomes.

Using the Yuangang area in Tianhe District, Guangzhou, as an empirical case, this study systematically explores the application and value of FBCs — an urban planning tool originating from the West—within the context of stock renewal and industry–city integration in Chinese megacities. Through theoretical review, case studies, site analysis, and design practice, the study demonstrates that with its core features— "form control prioritized over function control," "emphasis on public space quality," and "encouragement of mixed use" — FBCs can effectively address Yuangang's needs for industrial upgrading, spatial optimization, and quality improvement, serving as an appropriate technical tool to realize the overall vision of "innovation-driven development and industry–city integration."

2.Research Innovations and Limitations

(1)Theoretical aspect: This study reviews the development, theoretical origins, core ideas, and application cases of Form-Based Codes (FBCs), and compares them with the function-based regulatory planning system. It identifies the advantages of FBCs in terms of application scenarios, scope of control, effectiveness, scale, and project types, thereby clarifying their theoretical value.

(2)Application concept: Drawing on the transect-based idea of "comprehensive spatial elements across all scales," this study emphasizes the connection and nesting of three spatial levels — building, block, and district — and develops design guidelines based on this multi-scalar framework. By replacing "functional zoning" with "understanding of urban form elements," it introduces neighborhoods, corridors, and zones as spatial elements to construct the design framework. This attempts to break away from the traditional one-to-one correspondence between function and plot, providing methodological guidance for the morphological renewal of Yuangang's complex peri-urban environment. The resulting

framework forms a complete set of design guidelines, offering a new perspective and operational approach for similar urban regeneration areas.

(3)Methodological innovation: The “existing form-based zoning” proposed in this study is an effective method for analyzing complex built environments. Unlike traditional functional zoning, it innovatively divides the Yuangang area into nine existing form-based sectors, such as urban villages, residential communities, and various industrial parks, precisely identifying their spatial features, patterns, problems, and potentials. Based on the design vision and specific conditions of each sector, a multi-dimensional and diagrammatic set of design guidelines is established, covering “zoning–building–street–space.” This transforms macro-level urban design visions into operable and reviewable micro-level regulations, ensuring effective translation of planning intentions into implementation.

3.Research Outlook

(1)As FBCs originated in U.S. urban design practice, their theoretical roots and application paths reflect American characteristics. Their effective implementation relies heavily on continuous public participation and cross-departmental coordination. In China, how to integrate FBCs into the existing planning system and ensure long-term operation remains to be further explored. Future directions may include incorporating goals of smart cities and low-carbon technologies.

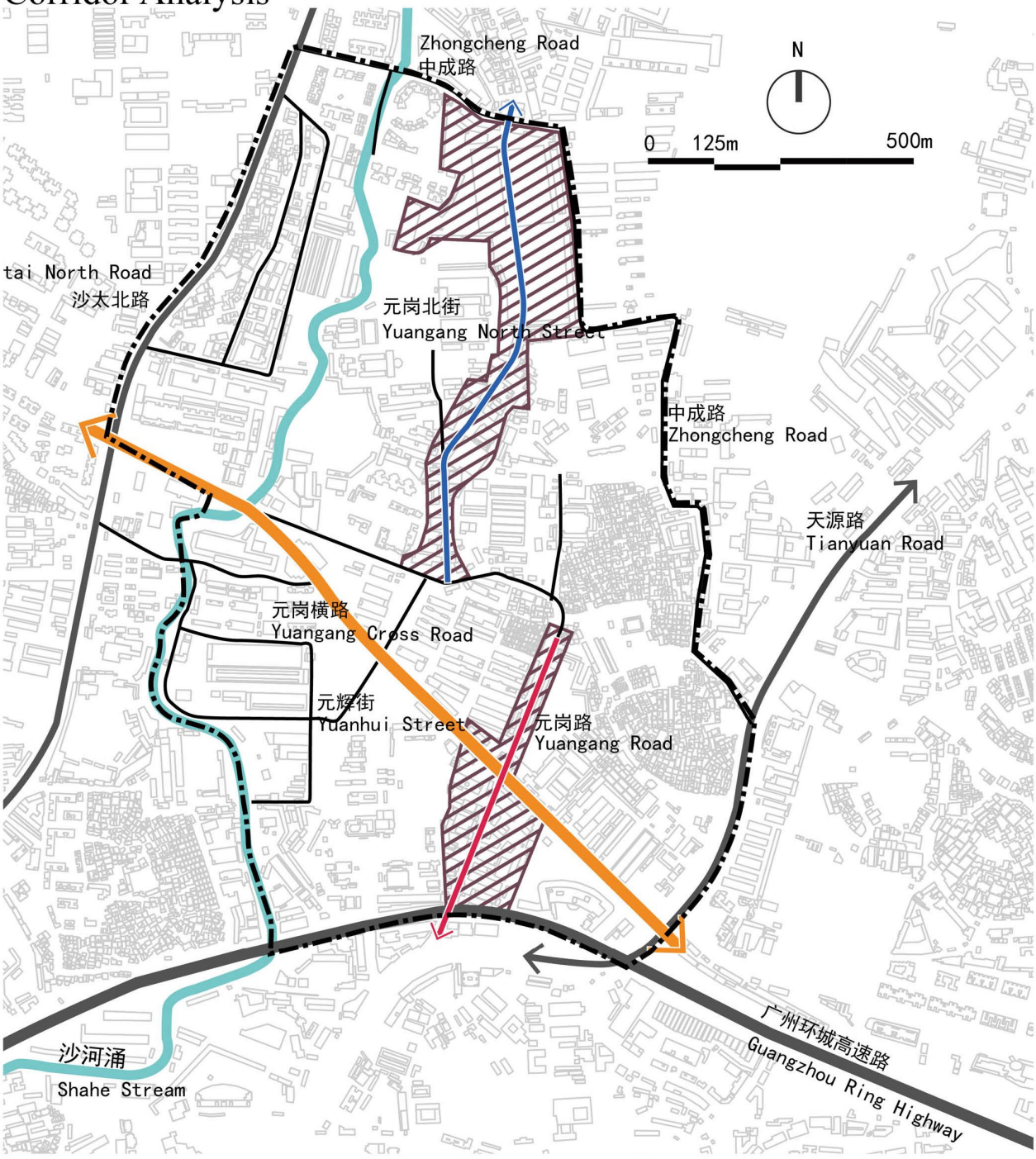
(2)This design responds to upper-level planning and focuses on the first-phase project of Shangyuanfang. In the long term, the redevelopment of urban villages will face more complex issues of property rights and interest coordination, requiring further policy and design exploration.

(3)Looking ahead, FBCs as both theory and method hold broad application value. This study aims to inspire wider adoption of FBCs and develop a China-specific form-based management tool to promote more refined, human-centered, and sustainable urban governance.

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Appendix：Form-Based Code of Yuangang Area

Corridor Analysis



1.Yuangang Cross Road



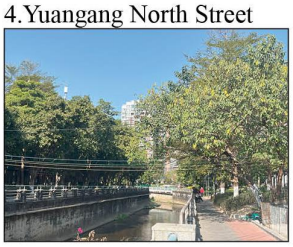
2.Yuangang Road



3.Yuangang North Street



4.Yuangang North Street



图例 Legend

City corridor	城市廊道
City branch corridor	城市支路
Vehicle corridor	车行廊道
Living corridor	生活型廊道
Production corridor	生产型廊道
Ecological corridor	生态廊道（沙河涌）

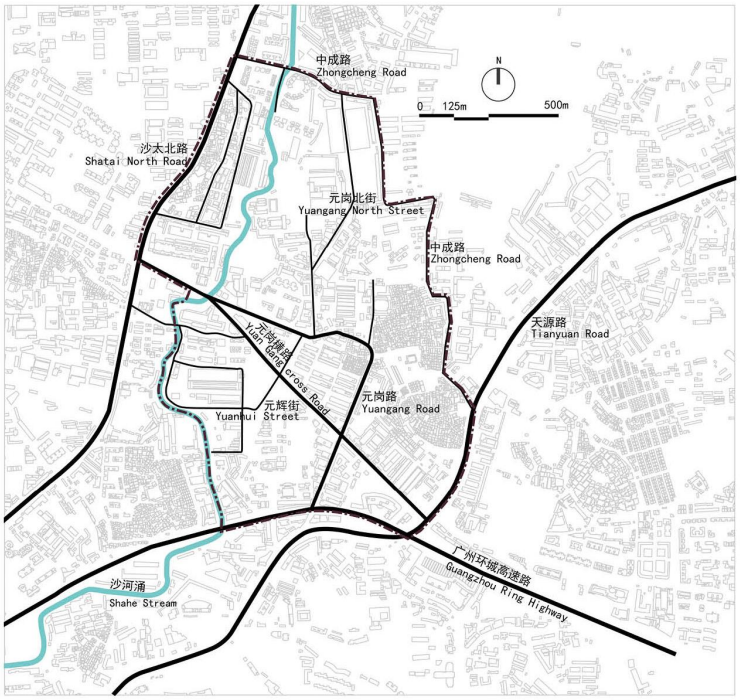
The corridor, as an important urban spatial element, is not merely a road serving transportation functions. Instead, it is an integrated spatial system that combines roads, building facades, and streetscapes. Within the site, there are four significant corridor spaces

1.Major Traffic Corridor:Yuangang Cross Road is the only east-west urban secondary arterial road running through the site, connecting Sha Tai Road to the west and Tianyuan Road to the east,linking the entrances and exits of small industrial parks and logistics warehouses on either side.

2.Residential Corridor:Yuangang Road is an important residential corridor within the site, with a high concentration of commercial service facilities along both sides,which also leads toTianhe Bus Terminal.

3.Production Corridor:Yuangang North Street is the only road connecting Guyu Market with the north-south roads. This corridor serves the logistics distribution and entry/exit of the wholesale market, as well as north-south public transportation, extending its influence to small factories and large markets. It is a vital production corridor.

4.Ecological Corridor:Shahe Stream is the only ecological element within the site and also serves as the administrative boundary. Currently, Shahe Stream is relatively fragmented, with some sections featuring waterfront walkways.



Road Grade Analysis

From the perspective of road structure hierarchy, there are mainly three levels of roads within the site. The current road layout on the ground is shown in the figure below. Here, one road from each of the three levels is selected as a representative to gain an understanding of the current road situation of the site.

Research zone	研究范围
Vliiage In the city	城中村
Residential area	居住小区
Small industrial aera	小型产业园
Small factory area	小型厂房园区
Large factory area	大型厂房园区

5.Shatai North Road



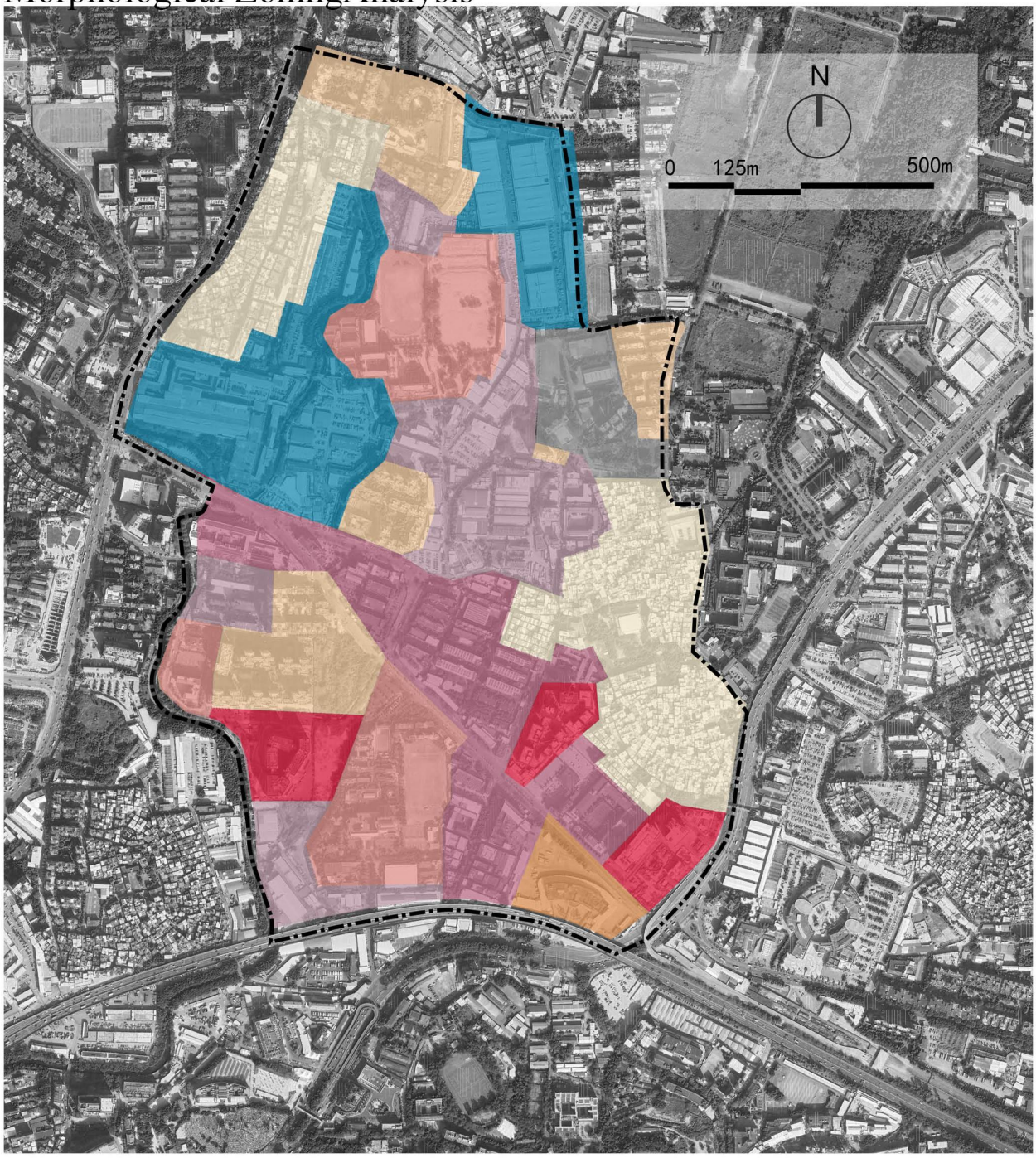
6.Yuangang Cross Rooad



7.Zhongyaun Road



Morphological ZoningAnalysis



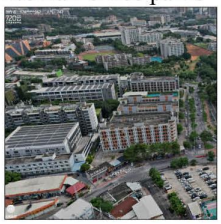
1.Urban villages



2.Residential areas



3.Small office parks



4.Small Factory Parks





As the city continues to expand, the Yuangang area in the near suburbs has experienced a transformation from agricultural land to built-up areas. The site now presents a complex and heterogeneous spatial structure, with various urban forms overlapping and interacting. These include enclosed vocational colleges, urban villages, factories of varying sizes from different time periods, newly developed residential communities, large commercial complexes, and apartment buildings built in the past decade. The built environment is characterized by a mixture of different development types, building densities, scales, and intensities, which are both interconnected and, at times, in conflict with one another.

1.Urban villages:Urban villages, which were constructed in earlier periods, are a unique settlement form that emerged as rural collective land was surrounded by urban land during the process of urbanization. These settlementsare typically

2.Residential areas:Small Industrial Parks:These complexes primarily serve a single residential function. Overall, the residential complexes within the study area tend to adopt a closed or enclosed layout in terms of planning structure.

3.Small office parks:developed and constructed in a unified manner, were primarily built around 2010 and are predominantly used for office functions, leased to small technology and new media companies. The internal landscape consists of buildings and surface-level parking lots.(Table 4-4 middle)Some external interfaces are connected by podium

4.Small Factory Parks:These areas are mainly dedicated to logistics and warehousing, with some buildings used as small-scale processing workshops. The ground floors facing the street host retail businesses such as restaurants and convenience stores, while the second and third floors are used for residential purposes.

5.Large-Scale Factory Parks:Different parks within the complex typically focus on distinct industrial sectors. Within the study area, there are two large industrial parks: one for the garment industry and another for grain and oil wholesale.The

6.Large shopping mall business building:Large-scale single-building commercial and business office complexes, developed through investment and construction after 2010, are characterized by their mixed-use functions.

7.Vocational Colleges:These campuses are usually connected to the city's transportation network through 1 or 2 entry points, with relatively enclosed interfaces. Inside, there are public facilities such as open-air sports fields and indoor gyms.

8.Special Buildings:The special buildings within the study area are primarily represented by Tianhe Bus Terminal, a large single-building structure that integrates multiple functions such as transportation terminals, passenger flow management, and office spaces.

5.Large-Scale Factory Parks



6.Large shopping mall building



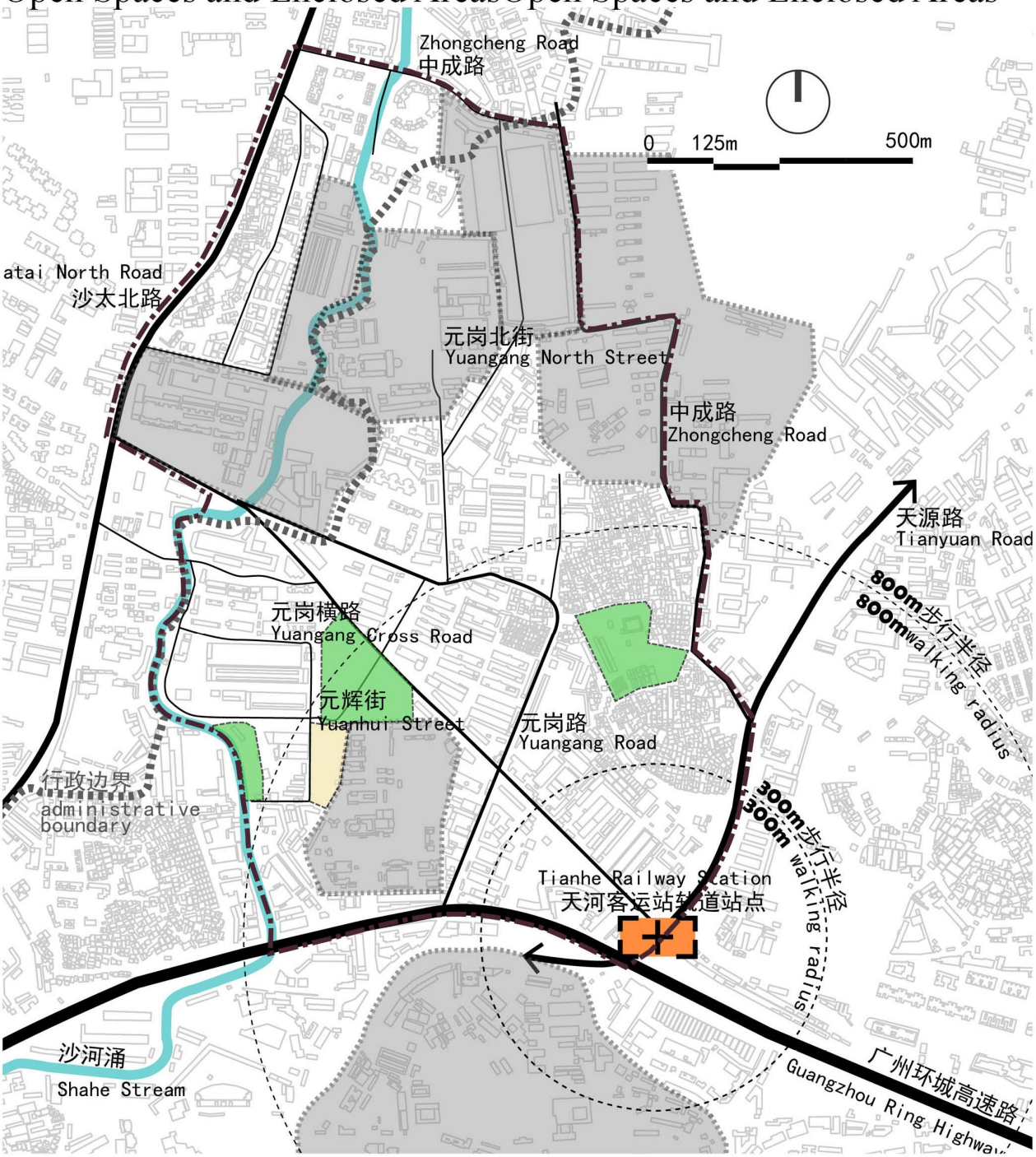
7.Vocational Colleges



8.Special Buildings



Open Spaces and Enclosed AreasOpen Spaces and Enclosed Areas



1.New Baijia Appareal Park



2.Guyu Markect



3.Guangzhou City Construction College(GZCCC)





Within the site, there are numerous enclosed areas with single functions, such as vocational colleges, warehousing and logistics parks, and large industrial parks. These areas are clearly separated from the urban fabric by physical barriers such as walls and ancillary buildings. The connections between these areas and the city are rather limited, primarily relying on vehicular roads as the main form of spatial linkage. This fragmentation disrupts the urban fabric, leading



Waterfront Park

An open square adjacent to the residential community and close to the riverbank, featuring both landscape and ecological value.
Entrances and exits: multiple
Functions and activities: leisure gatherings, walking tours.





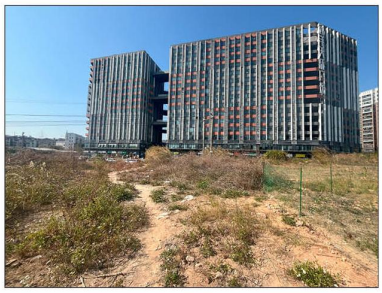


Yuangang Park

The open park in the central area of the urban village features buildings such as a farmers' market and a commercial street to serve the residents.
Entrances/Exits: Multiple
Functions/Activities: Sports, leisure gatherings







Unused Land
To the east of Yuanyang Tianjiao, at the boundary with Guangdong University of Foreign Studies, there is a large area of unused land currently covered with overgrown vegetation. At the intersection of Yuanhui Street and Yuangang Cross Road, there is another significant green space, which is currently enclosed. This area holds potential and value to be developed into an open



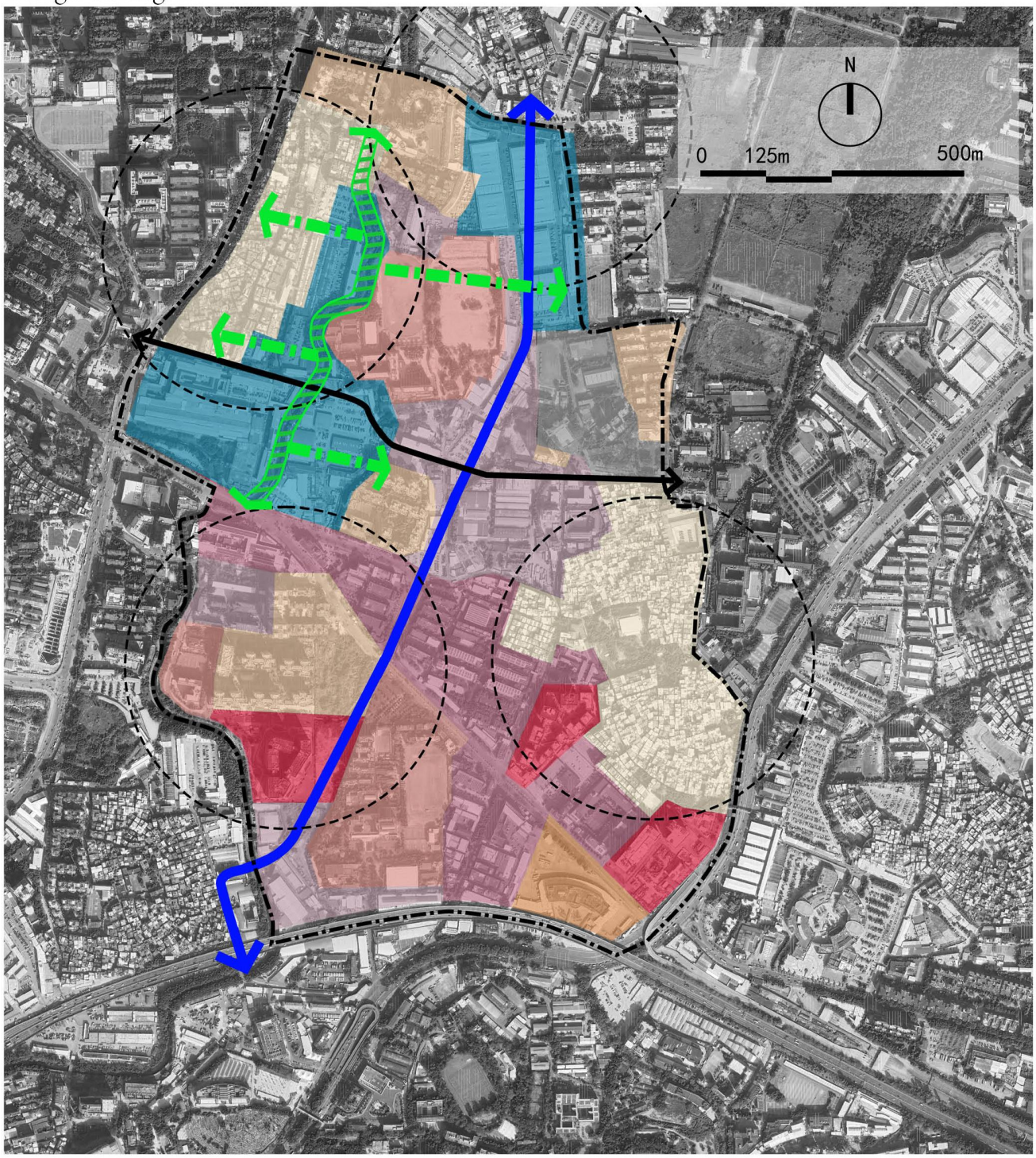


1.New Baijia Appareal City:An introverted large-scale park, with open spaces inside used as parking areas for large vehicles, and the surrounding buildings forming an introverted space.

2:Guyu Markect:Large-scale buildings are temporary structures that provide venues for various functions such as warehousing and wholesale. They are enclosed by strip-shaped buildings to form an inward-oriented park.

3.Guangzhou City Construction College(GZCCC):An independent administrative area, equipped with various types of building spaces and sports venues.

Design Strategies



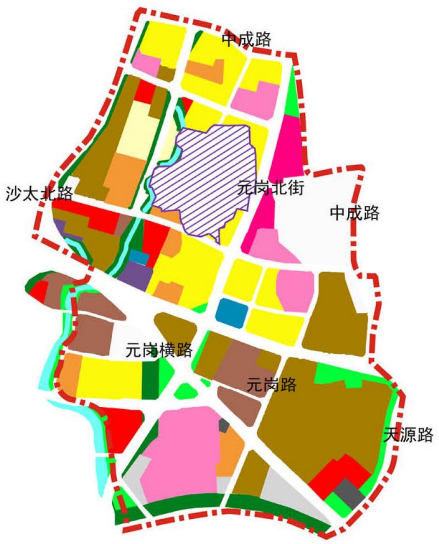
Strategy legend　策略图例

- Future or existing residential areas within the research area, 300m walking radius.
  研究范围内将要建设或现存的居住区，300m步行半径.
- Enhance the north-south traffic connection and enhance the site's connection with the urban road network.
  增强南北向的交通联系，增强场地与城市路网的连接。
- Strengthen the east-west traffic connection, dredge the internal roads in the area, and increase the accessibility and connectivity between the districts.
  增强东西向的交通联系，疏通片区内部道路，增加各分区之间的可达性与连接度。
- The landscape style along the embankment of Shahe Chung should be repaired and its landscape and ecological value should be brought into play.
  修缮沙河涌沿堤岸的景观风貌，发挥其景观和生态价值。
- From the view gallery and green space, it is connected with the zoning inside the site.
  从视廊和绿地空间上与场地内部与各分区进行连接。



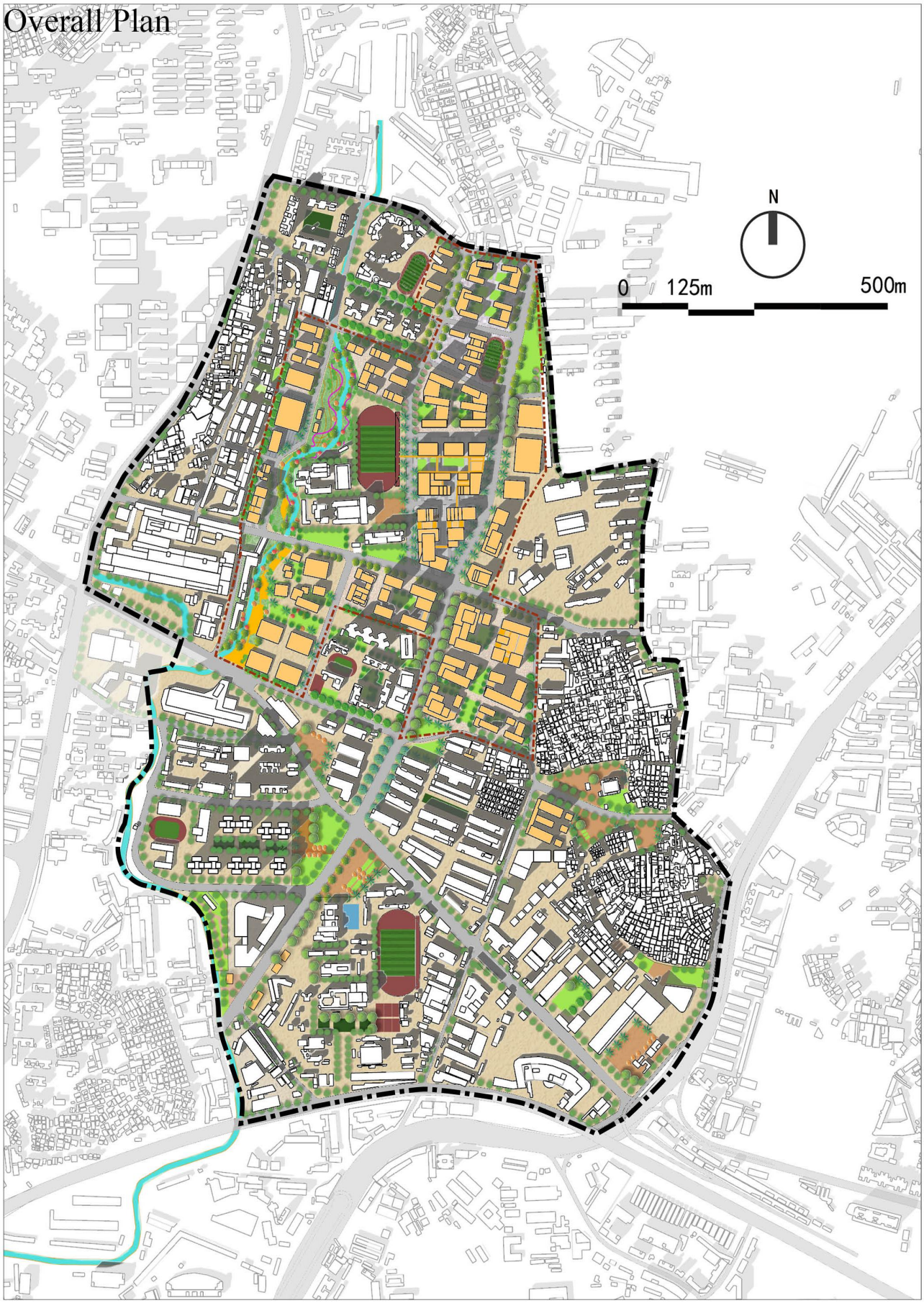
This design is based on the planning scheme of the Huowushan Innovation Source Zone, fully considering the land integration plan for the existing Yuan'gang Village area under the leadership of this project. By demolishing certain parts of Yuan'gang Village's existing land, industrial space will be released, serving as the starting point for the spatial design. The project will re-integrate three spatial elements: roads, old and new buildings, and public spaces, from the perspective of morphological principles. This will establish new spatial elements such as zoning, corridors, and a five-minute living circle.

The Yuangang area has been incorporated into the "1+N" redevelopment plan of the Huawu Mountain Innovation Source Area, focusing on building high-quality sci-tech industrial carriers, public service facilities, and a convenient transportation network. The plan aims to realize the "Creation (Technology Innovation)— Production (Industry Aggregation)— City (Urban Renewal)" model. The goal is to achieve the triple objectives of urban renewal, industrial upgrading, and improving the quality of life by promoting new models and fostering multi-party cooperation.The Yuangang area has been incorporated into the "1+N" redevelopment plan of the Huawu Mountain Innovation Source Area, focusing on building high-quality sci-tech industrial carriers, public service facilities, and a convenient transportation network. The plan aims to realize the "Creation (Technology Innovation)— Production (Industry Aggregation)— City (Urban Renewal)" model. The goal is to achieve the triple objectives of urban renewal, industrial upgrading, and improving the quality of life by promoting new models and fostering multi-party cooperation.The urban renewal of areas like Changban Village and Yuangang Village will release valuable land resources. The planning includes an additional 488,500 square meters of building space, incorporating commercial, residential, educational, and ecological land uses to promote a balanced mix of work and living spaces.In the control plan, existing village residential land , economic development land , Category I industrial land, and sports land will be converted into Category II residential land, other commercial land, primary and secondary school land, service facilities land, park green space, and cultural heritage land. Additionally, 39 new public service facilities will be added (including school, kindergarten, and community health stations), which will increase the coverage of the 15-minute living circle to 90%, enhancing the area's community appeal.





(1)Use Yuan'gang North Street as an important axis to connect the northern and southern parts of the site. Commercial services, pocket parks, and various types of buildings will be integrated along both sides of the road, creating an open and continuous street frontage to develop a comprehensive service corridor.
(2)Strengthen the east-west traffic connections of the site, relieving congestion along Yuan'gang Horizontal Road, and improving road network accessibility and the overall completeness of the road system.
(3)Fully exploit the ecological landscape value represented by Shahe Creek, developing an open ecological corridor. Pocket parks, linear green spaces, and other elements will be used to integrate the ecological landscape into the east and west sides of the site, activating the urban space through open, green views.
(4)Create four 5-minute living circles centered around residential areas, supplementing commercial services, public activities, and other civic spaces.


Overall Plan
N
0
125m
500m

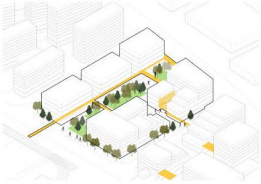
Based on the requirements of each morphological zone as specified in the morphological control planning,this section provides illustrative design for the different zones within the design scope,plans for the spatial nodes covered,and proposes requirements for spatial form construction.It offers guiding design demonstrations for open space forms, spatial activities,and spatial effects.



Spacical node 空间节点

	Research zone	研究范围
	Design zone	设计范围
❶	Vliiage in the city	城中村
❷	Vliiage Square	城中村广场
❸	Shopping mall	大型商场
❹	Bus terminal	客运站
❺	Small industrial area	小产业园区
❻	Green park	公园绿地
❼	Residential area	居住小区
❽	Community park	社区绿地
❾	Senior high school	九年制36班学校
❿	Primary school	小学
⓫	Amalgamated dwelling	集合住宅
⓬	Appartment	公寓
⓭	Science and innovation industrial area	科技创新产业区
⓮	New small industrial area	新建小产业园区
⓯	Waterfront business area	滨水商业街区
⓰	Large industrial area	大型产业园区
⓱	Higher vocational college district	高职院校区
⓲	Waterfront corridor park	滨水廊道公园
⓳	Waterfront open square	滨水公共广场

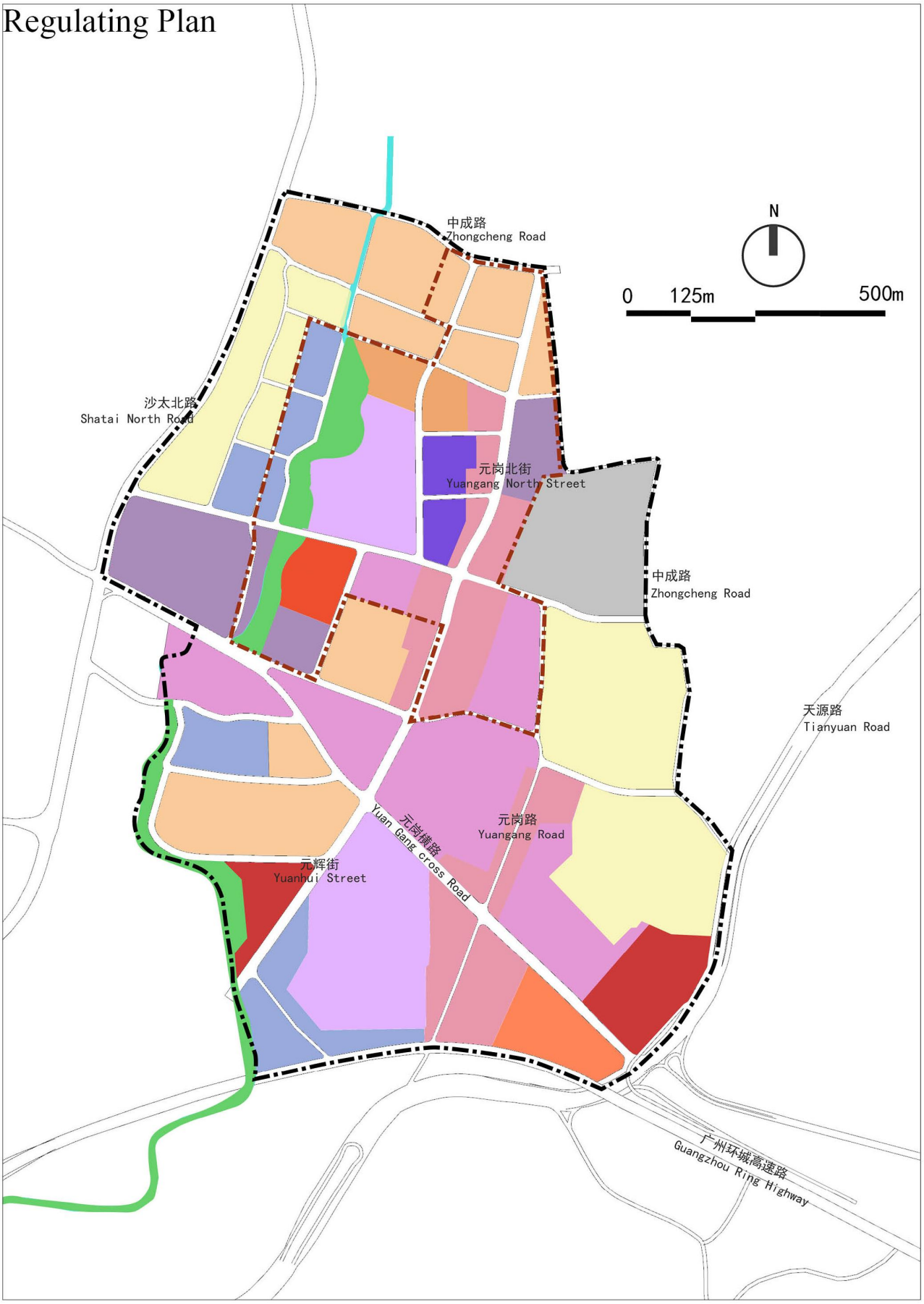











Regulating Plan
N
0
125m
500m
中成路
Zhongcheng Road
沙太北路
Shatai North Road
元岗北街
Yuangang North Street
中成路
Zhongcheng Road
天源路
Tianyuan Road
元岗路
Yuangang Road
元岗横路
Yuan Gang cross Road
元辉街
Yuanhui Street
广州环城高速路
Guangzhou Ring Highway

This section defines the morphological zoning within the study and design areas. These zones are based on the analysis and optimization of the building clusters within the research scope. Most areas feature a mix of land uses. This approach differs from traditional regulatory planning methods, which typically segregate residential, commercial, industrial, and public service functions into separate zones. Such segregation often leads to isolated and disorganized urban forms, requiring residents to rely on cars or public transportation for their daily activities.

(1)Residential District:The design aims to convert this space into a concentrated residential community for relocation purposes during the subsequent urban village redevelopment. It will also provide housing for the population attracted by industrial upgrades.

(2)Mixed Rental and Sale Zone:The design converts it into a mixed-use residential and apartment zone, serving as housing for the population attracted by industrial upgrades.The design converts it into a mixed-use residential and apartment zone, serving as housing for the population attracted by industrial upgrades.

(3)Innovation and Technology Industry Zone:The design converts it into industrial office spaces. The zone will accommodate a range of architectural forms, including courtyard and stepped buildings.

(4)Comprehensive Service Corridor:The design converts it into a mixed-use space with services such as office spaces, conference facilities, commercial retail, and residential areas. These will serve the population attracted by industrial

(5)Waterfront Commercial Area:The design will transform it into a waterfront commercial district with district-style buildings and landscapes. This will provide high-quality commercial space for the region after industrial transformation.

(6)Waterfront Corridor Park:The design will convert it into a waterfront corridor park, offering high-quality public space and ecological environments.

(7)Vocational College Zone:The environment will be optimized, and a variety of building types, including slab and courtyard buildings, will be accommodated to support industrial diversification. Spatial quality will be enhanced to further

(8)Small Factory Zone:The design will convert it into industrial office space. It will accommodate a variety of building types, such as courtyard and stepped buildings. and vitality.

(9)Small Industrial Park:The design will convert it into industrial office spaces, accommodating a range of architectural forms, including courtyard and stepped buildings.

(10)Large Industrial Park:The design will convert it into industrial office spaces, accommodating a range of architectural forms, including courtyard and stepped buildings.

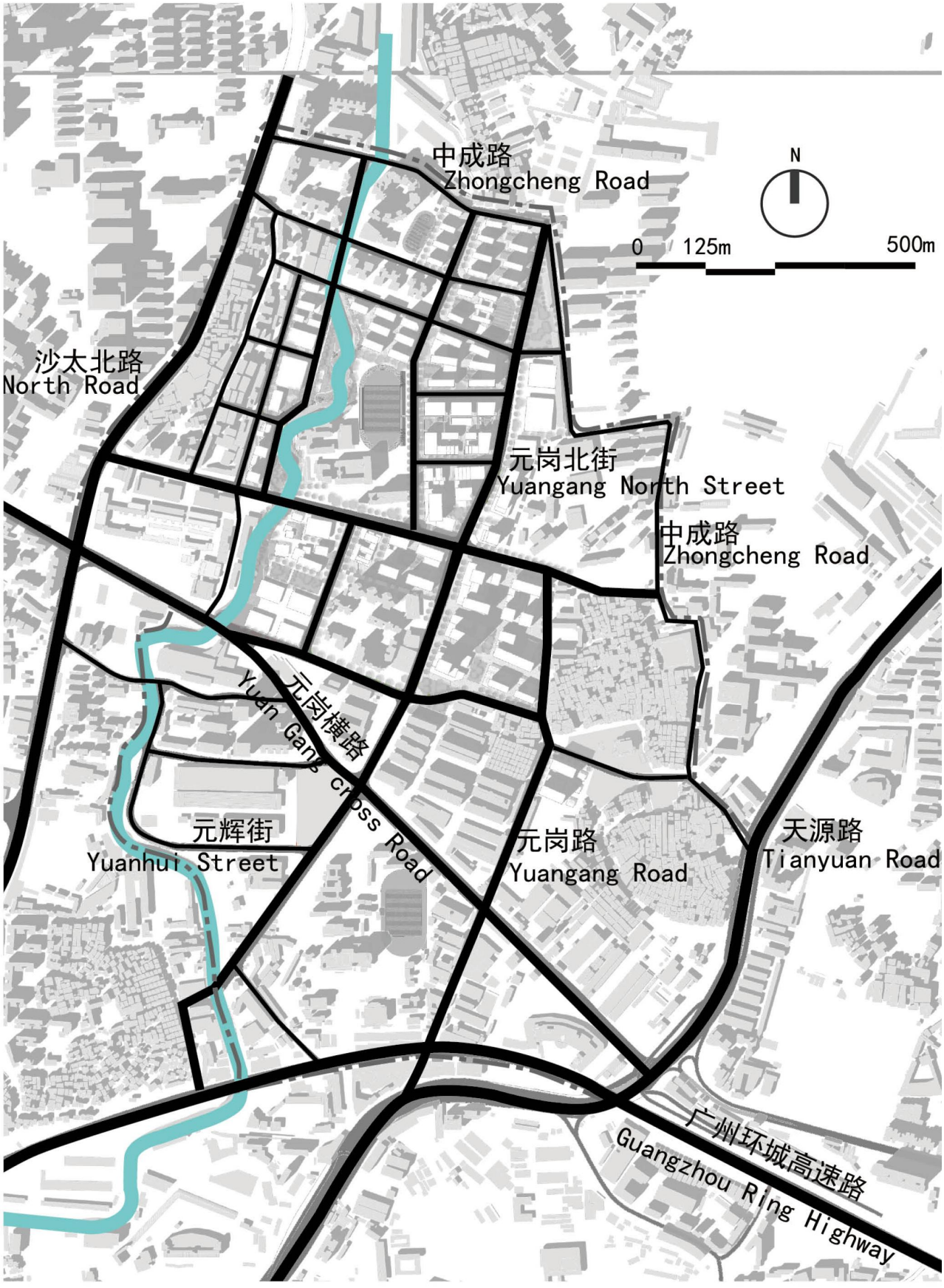
(11)Large Shopping Mall Buildings:These modern buildings are equipped with underground parking facilities. For these large-scale building zones, the original commercial, residential, and office functions will be retained.

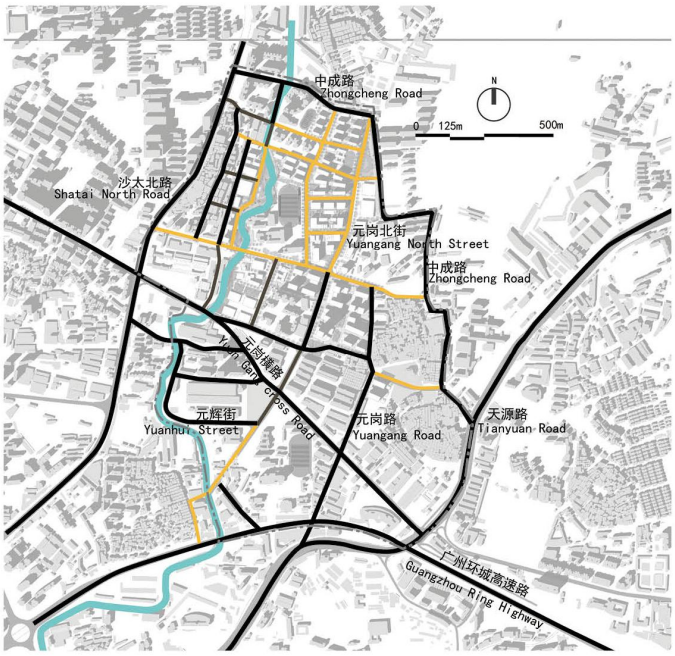
(12)Special Zone:As a public transportation hub, this area will be optimized to enhance the city gateway's impression and improve pedestrian and vehicle facilities.

(13)Urban Village:The design will maintain a residential focus with auxiliary services. The connection to urban roads will be improved, and the internal road network will be optimized.

(14)Military Zone:The military zone is considered a special area, and no design will be made for it in this planning.

Road Plan


中成路
Zhongcheng Road
N
0
125m
500m
沙太北路
North Road
元岗北街
Yuangang North Street
中成路
Zhongcheng Road
元岗横路
Yuan Gang cross Road
元辉街
Yuanhui Street
元岗路
Yuangang Road
天源路
Tianyuan Road
广州环城高速路
Guangzhou Ring Highway



The new roads will be designed to align with the existing topography, taking into account the presence of existing buildings. According to the planning control documents for the first phase of the Yuan'gang project, all areas except the current Gu Yu Market will be preserved. Efforts will be made to retain the built environment in other zones, maximizing the use of open spaces, underutilized large parking lots, and other available land for road construction. Areas such as small factory parks and large factory parks, which are not suitable for industrial transformation and upgrading, will be excluded. The design will aim to minimize the impact on existing buildings and the surrounding environment.

Road construction and reservation
道路新建保留 图例

Research zone	研究范围
Reserved roads	保留道路
Retrofit roads	改造道路
New roads	新建道路



Urban secondary roads
•A new urban secondary arterial road within the design area, extending north-south from Yuan Gang North Street through the site.
•The secondary urban arterial road will be designed with a minimum of four lanes of motorised traffic in each direction and a median green belt.
•To ensure separation of motorised and non-motorised traffic, the use of a green belt for separation is recommended.



Urban branch roads
•Four new urban side streets within the design area.
•Urban secondary roads are designed with at least two lanes of motorised traffic in each direction and a central dividing green belt.
•Ensure the separation of motorised and non-motorised traffic, the use of green belts for separation is recommended.



Community Streets
•Within the design area, a number of new neighbourhood streets will be built to connect urban side streets and secondary urban arterials, supplementing the structural hierarchy of the road network.
•Urban side streets are pedestrianised as a priority, ensuring two-way lanes for motor vehicles, and can be built without a central dividing green belt. Motorised and non-motorised lanes can be separated without a split.

This design aims to enhance the connectivity between the site and the city, as well as internal road connectivity, to address the fragmentation and disjointed road issues caused by large, enclosed industrial parks. The design requires strengthening the north-south connectivity by expanding Yuan'gang North Street, forming a continuous urban secondary road from Zhongcheng Road in the north to Yuan'gang Horizontal Road in the south.

Grade of road Legned 道路等级 图例

Research zone	研究范围
City main road	城市主干道
City secondary road	城市城市次干道
City branch road	城市支路
Community street	片区街道

The overall road design specifies the principles of road design as connectivity and structural integrity of the road network. This design improves the road hierarchy system of urban main, secondary and branch roads. It also supplements the streets in the district, and constructs the urban road structure system of urban main roads - urban secondary roads - urban branch roads - community streets, as shown in Fig. 6-35, so as to facilitate the district to internal roads and external roads for better connection.


Open Space Code
N
0
125m
500m
1
2
3
4
5
6

The design of rich open spaces and green spaces is an important strategy in this project. This plan aims to leverage the landscape value of the Shahe River, activating its ecological and scenic attributes. At the same time, within a broader research scope, it intends to incorporate squares and green spaces to systematically enhance the quality of the spatial environment, providing an attraction for the future industrial transformation and development of the



Waterfront Park:
Softening the hard interface of the river channel and enhancing its hydrophilicity.
Openness: Open to all residents in the area and all residents in the city.
Usage activities: Various activities such as leisure, strolling, sightseeing, cycling, and running.。



Community Park Green Space:
The large green space on the east side of the residential area is primarily characterized by plant and green landscape, with hard-surfaced paths serving as park trails.
Accessibility: Open to all residents of the district and the entire city.
Usage and Activities: Suitable for a variety of activities such as walking, sightseeing, gatherings, and leisure.



Small Cluster Green Space:
Green space between building clusters, with small plant groupings dominating the landscape and hard paving as park paths.
Openness: open to people within the surrounding building groups.
Usage activities: Recreationgarage can also be considered.



Riverside Public Plaza:
The waterfront plaza in the southern section of Hechong, a large open hard square, can consider hydrophilic terrace design, with small plant group landscape, can be designed in large hard paving small green plants or green group.
Openness: adjacent to the waterfront commercial area, open to all people in the city.
Use activities: leisure, party, commercial bazaar, etc.



Urban Village Square:
A small open hard plaza in the urban plaza between Sheung and Shiang Yuan Gang, the waterfront plaza in the southern section of Hechong.
Openness: located inside the urban village than adjacent to the waterfront commercial area, mainly for urban village residents.
Usage activities: leisure, party, commercial bazaar, sports ground, etc.



Building Front Plaza:
Plaza in front of the commercial building, small open hard plaza, can design small green planting belt or green space group at the edge of the plaza.
Openness: adjacent to large commercial buildings, open to all people in the city.
Use activities: leisure, distribution, commercial bazaar, etc.

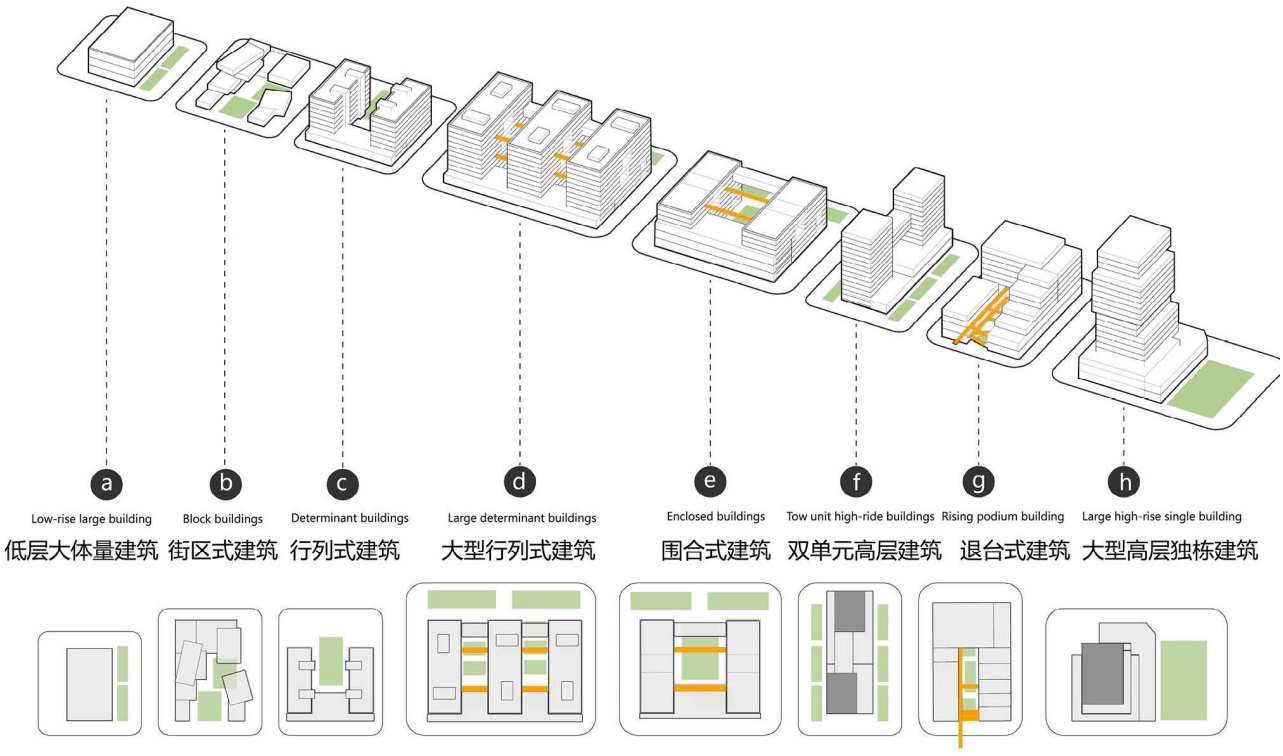
Open space node 空间节点
Research zone 研究范围
Design zone 设计范围
1 Waterfront corridor park 滨水廊道公园
2 Community park 社区绿地
3 small green space 小型组团绿地
4 Waterfront open square 滨水公共广场
5 Square of village city 城中村广场
6 Building square 建筑前广场

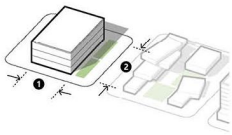
Building Type Code

This guideline proposes a reference for permissible building types within the design scope of the Meta-Gang Innovation Portal District. Some of these building types are derived from the extraction and optimization of types across the entire research area. They are categorized by form and provide a selection of building types, offering diverse options to guide the next level of specific architectural design.

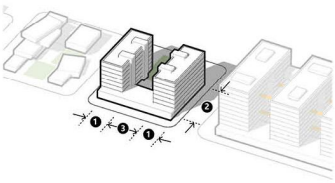
Based on the eight types of buildings proposed within the design scope,these buildings are arranged by intensity, ranging from low-intensity (low-rise large-volume buildings)to high-intensity (large standalone buildings).Each zone allows the selection of individual building types or groups from the following table for specific design,while also meeting the requirements for specific indicators in the subsequent tables for different types of buildings.

	R	RS	SF	SI-1	SI-2	SI-3	WB	WP				
Low-rise large building				-	-	Y	-	-	-	-	-	
Block building	Y		Y					Y	Y			
Determinant building			Y	Y	Y	-	-	-	-	-		
Large determinant building				-	Y	Y	Y	Y	Y	-	-	
Enclosed building			-	-	Y	Y	Y	Y	-	-		
Tow unit high-rise building				-	-	-	-	-	Y	-	-	
Rising podium building				-	Y	-	Y	-	-	Y	-	
Large high-rise single building					-	-	-	Y	Y	-	-	-

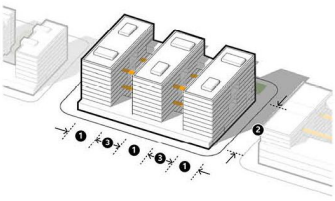




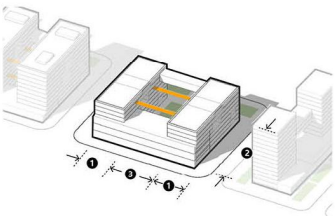
Low-rise large-volume buildings:
•Low-rise buildings with a large volume,typically 1-4 stories tall.
•Functionallyemphasizes compatibility,can be used for logistics warehousing,production workshops,and other functions.
•On the street-facing side,consider the space required for goods stacking;the open land on the non-street-facing side can be designed as a parking lot to accommodate both passenger and cargo vehicles.
•Small green spaces can be arranged along the side of the building.



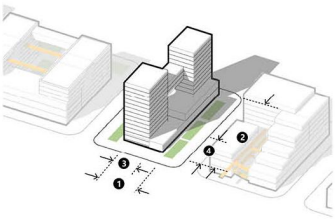
Block-style architecture:
• A cluster of street-oriented buildings with a height of 2-4 floors, without restrictive requirements on bay width and depth. However, it should ensure a fragmented building mass, ample ground-level open space, green space, pedestrian space, and barrier-free design.
• This type of building primarily appears in waterfront commercial areas, community service centers in residential districts, nursing homes, and similar facilities.



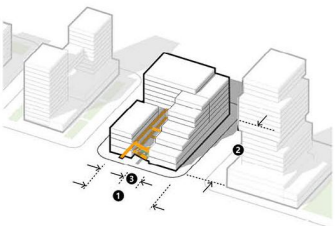
Grid-Style Architecture:
• Cluster of row buildings with a height of 5-7 floors.
• This type of building is primarily used for residential purposes and must meet design requirements for natural lighting and ventilation, as well as fire safety standards. Emphasis is placed on compatibility in the vertical direction, with the ground floor and first floor potentially serving commercial or service functions.
• The ground area on the non-street-facing side of the buildings can be designed as parking spaces to accommodate cars. A centralized large underground parking garage should also be provided as part of the design.



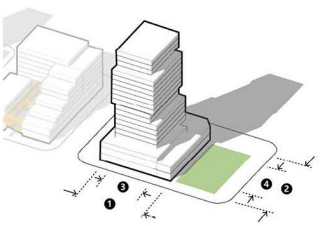
Enclosed Buildings:
• A cluster of row-style buildings with a height of 6-8 floors, featuring larger depths, bays, and volumes compared to typical row-style buildings.
• This type of building has broader functional applicability, suitable for use as apartments, industrial offices, etc. Emphasis is placed on vertical compatibility, with the ground floor and second floor potentially serving commercial services or similar functions.
• The ground area on the non-street-facing side of the buildings and the spaces between building clusters can be designed as parking lots to accommodate car parking. Alternatively, a centralized large underground parking garage can also be considered.



Double-unit high-rise building:
•Cluster of row buildings with a height of 5-7 floors.
• This type of building also has a wide range of applicable functions, suitable for use as apartments, industrial offices, etc. Emphasis is placed on vertical compatibility, with the ground and first floors' podium areas serving public activities and other functions.
• The ground level on the non-street-facing side of the buildings and the spaces between building clusters can be designed as parking areas to accommodate cars. Small green spaces should be arranged between building clusters to provide ample landscape areas.
• Vertically, considerations can be given to designing skywalks, terraces, or other elevated spaces to



Setback Building:
• A building cluster consisting of two high-rise unit buildings with a height of 12-15 floors.
• This type of building has broad functional applicability, suitable for use as industrial offices, apartments, etc. Emphasis is placed on vertical compatibility, with the ground and first floors' podium areas available for commercial services, public activities, and other functions.
• The non-street-facing ground area and the space between building clusters can be designed as parking lots to accommodate car parking. A large underground parking garage should be provided as part of the facilities.
• Small green spaces and pocket parks should be arranged between building clusters to provide



Large High-rise Single-building Structures
• A setback-style building with a height of 8-10 floors.
• This type of building is primarily used for industrial office purposes and must meet design requirements for daylighting and ventilation. Emphasis is placed on functional compatibility in the vertical direction, with the first and second floors potentially serving as commercial services, such as convenience stores and cafes.
• The ground level on the non-street-facing side of the building can be designed as a parking area to accommodate car parking. A large underground parking garage should also be provided as part of the design.

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