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Vertical Urban Design and Thinking within the Framework of Urban Regeneration

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Abstract By limiting population and land resources, a high-density urban form has become the inevitable choice for central cities in the rapid growth of many large cities in China. Due to the shift in urban growth and focus, high-density urban areas require restoration and improvement. This study intends to combine ancient and new districts, establish strategies for enhancing urban function, spatial utility, industry, and transportation, and thus enhance regional holistic effectiveness, by performing in-depth research.

Keywords Urban Design, Urban Regeneration, Vertical City

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1. Introduction

1.1. Urban Regeneration

Cities have needed urban renewal ever since they were founded, and it might be said that most cities, especially those with a lengthy history and continuing existence, are constantly undergoing some form of regeneration. The city is continually changing as a result of the development of technology and civilization, as well as the evolution of the material and spiritual aspects of human society. Changes in the city's function, structure, form, and other characteristics are ongoing, as is the process of urban regeneration.

Along with urban development, the meaning of "urban regeneration" has expanded beyond reconstruction and repair, and numerous novel ideas and approaches, such as "organic urban renewal," have been presented. Improvements have been made to both the theory and practice of urban regeneration in China in recent years, and more emphasis is being paid to the domestic urban form. This paper suggests that urban regeneration is an approach to bettering urban areas, with the goal of bringing them in line with the needs of modern urban social, cultural, and economic development; this means addressing issues with the city's physical structure, as well as its layout and design.

1.2. High-Density City Center

For the purposes of city planning, "density" is defined as 'the number of buildings, people, or jobs per unit land area" (Tang and Fu, 2003). The physical construction environment of a city is in a high-density state in the center of the urban region, where the population, construction, economy, and transportation are all greatly concentrated. High-density urban regeneration is fraught with difficulties; for example, it has a high building intensity, and if complying with the previous renewal model, further development is impossible. Therefore, it is a challenge for China's major cities to figure out how to sustainably revitalize their high-density urban areas.

Nonetheless, most contemporary studies on the regeneration of high-density urban areas continue to focus on the spatial form, while ignoring ecological design, traffic organization, and function research. They pay close attention to the progressive effect of the present project and the next-to-be-built project, but disregard the potential for sustainable operation in the future. The high density of space in many core urban districts is the result of a focus on design outcomes, while ignoring the control and transmission of design outcomes; the function, traffic, ecology, and other factors are inconsistent with their high-density form.

1.3. Vertical City

To address Europe's housing scarcity, Le Corbusier suggested the three-dimensional city design in 1945, stating that "a city must be centered, and only a centralized city can have vitality." The contemporary concept of three-dimensional cities are based on in-depth thought and active research of urban growth in China, and are based on the highly concentrated characteristics of population, construction, economics, and transportation exhibited in high-density urban centers in China. Vertical cities represent an intense and efficient notion, frequently

depicting vertical space. More importantly, they improve the layout and form of urbanization and improve the efficiency of urban land use, solve different difficulties in high-density central urban areas, and increase vitality and efficiency through functional, three-dimensional vertical traffic, and other measures. As a result, vertical cities depict not just high-rise buildings and high density, but also a type of concept and strategy for resolving the challenge of high density.

2. Experimental practice

2.1. Background of Changsha Financial City

Changsha, Hunan Province, is located in the middle hinterland, connecting the east and west and the south and north. It is situated at the crossroads of the Yangtze River's horizontal axis and the vertical axes of Beijing and Guangzhou, in the national urbanization pattern of "three verticals and two horizontals." It is an important hub city of urban agglomeration in the Yangtze River's middle reaches and the Yangtze River's economic belt. Hunan Province has consistently strengthened its support for the development of the finance industry since the "12th Five-Year Plan." The financial industry's share of provincial GDP remains low, making it one of Hunan Province's "weak links" in development. Changsha's existing Furong CBD, Meixi Lake CBD, and Xingsha CBD are all comprehensive business areas that need a center with a full financial framework. Hunan Financial Center, as one of the important functional areas, aims to build a first-class regional financial center in central China and the only provincial financial center, as well as a central financial center that not only reflects the characteristics of the financial industry, but also reflects Hunan's cultural characteristics.

The Changsha Financial Center in Hunan Province has a design scope that extends to the intersection of Xianghua Road and Xiaoxiang North Road in the north, the intersection of Riverside Landscape Road and Xiaoxiang Avenue in the south, the Xiangjiang River in the east, and to the west along Changwang Road and Chashan Road in the west, with a total land area of 2,800 square meters and a planned residential land area of 231,540 square meters (currently approved and built). There are 229,727 square meters of commercial and residential land (124,298 square meters allowed for building), 831,939 square meters of commercial-only land (533,984 square meters approved for construction); 1,182,110 square meters of education, green space, cultural institutions, and other lands (10,655 square meters have been approved for construction). The plot ratio of the overall land is now scheduled to be 2.3:1, and the plot ratio of the built residential buildings is all above 3:1, which corresponds to a typical high-density urban region. This planning necessitates that the plots that have been created or are being developed present acceptable improvement measures, but they cannot be modified (see Figure 1).

2.2. Problem Identified

2.2.1. Positioning Adjustment

In 2009, the region's emphasis was on the riverside commercial area, the riverside residential district, and the

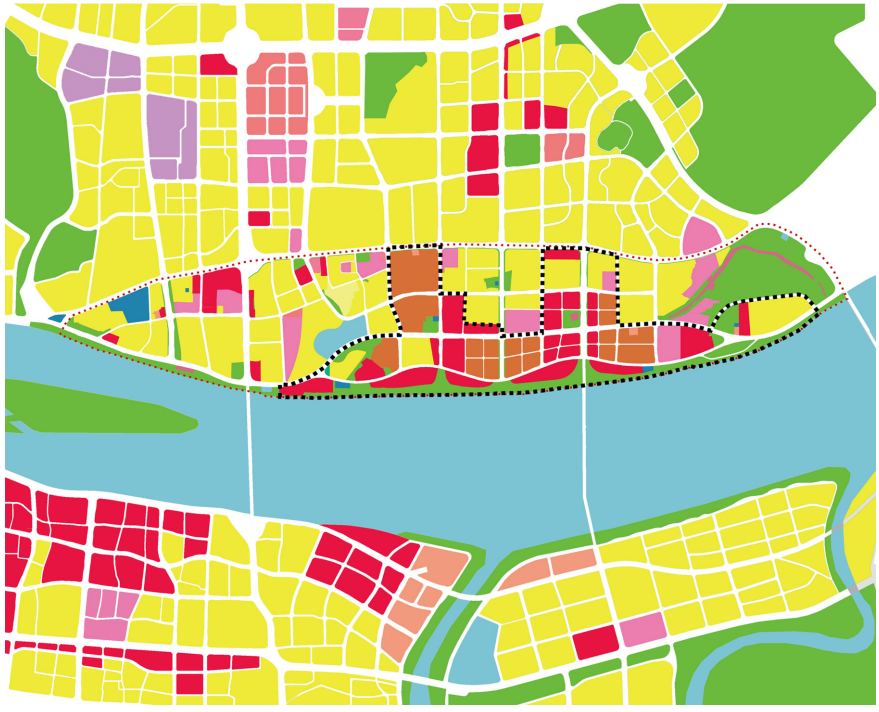


Figure 1. Land-use planning of the Changsha Financial District. Source: East China Architectural Design & Research Institute.

cultural, sightseeing, and tourism service base. Due to urban expansion, the direction was shifted in 2014 to the national Smart City Demonstration Zone and Xiangjiang New District's new business core. Changsha's finance industry has gradually grown into an important pillar industry, thanks to a strong momentum of production capacity expansion. As a result, it was designated as Hunan's financial hub in 2016. The existing base is responsible for the construction of the office, residential structures, and riverbank landscape. Many previous items do not fit the latest positioning due to positioning changes, resulting in numerous conflicts. Repairing the land use function, road traffic, landscape greening, public space, and other features, as well as injecting vitality to integrate the old and new regions, are all important.

2.2.2. Complex Land Use

The Financial Center's planned residential area is 562,710 square meters (231,540 square meters are permitted for construction), the commercial and residential area is 229,727 square meters (124,298 square meters are approved for construction), and the commercial space is 831,939 square meters (533,984 square meters have been approved for construction). There are 1,182,110 square meters of education, green space, cultural amenities, and other lands (of which 10,655 square meters have been built). From the standpoint of land transfer and development, there are numerous structures that have been built, are under construction, or are in areas where land is used; thus, built or under-construction projects must consider the status quo, consider integration the overall plan for the future, and ensure the local interventions are coordinated with the whole.

2.2.3. Fragile Urban Public Space

The first phase of developed public space is characterized by a lack of resting places and popular green areas, but the public space in phase two has yet to be rebuilt. The area has natural ponds and cultural relic archways. The entire plot is 5 to 6 meters above the road and can be linked with the subway station as a sunken square and the memorial archway for landscape design (see Figure 2).

Tanshan Road also runs along the riverside landscape belt. The fundamental construction of the riverfront landscape belt on the south side has been finished, but the renovation on the north side has not been completed, resulting in a discontinuous landscape. The riverside landscape belt on the north side of Tanshan Road – a hard embankment with an elevation difference of 8 to 9 meters between the river embankment and the water surface – can be linked with the public space system to maximize and enrich the existing open space.

3. Strategy discussion

3.1. Improving Urban Layout

The project is situated between two natural areas, Gushan Forest Park and Yuelu Mountain, with a favorable ecological environment of Xiangjiang River to the east. The two mountains meet at the project site, and the



Figure 2. The existing memorial archway view. Source: Changsha Waterfront Construction and Development Co., LTD.

Liuyang River flows into the Xiangjiang River on the other bank. Due to the high intensity of building in the area, this study analyzed the qualities and indicators of each plot of land in the area to determine the feasibility of modification.

3.1.1. Introducing the Mountain to the City

This design arranged a green corridor from south to north within the base in this layout, in addition to connecting the northern and southern riverbank lines of Tanshan Road. The green corridor's backdrop is based on various existing scattered green spaces, to which is links by adding green belts through unconstructed plots. Two green lanes connect Yuelu and Gushan mountains, tracing the beginnings of Changsha's millennia-old mountain range.

3.1.2. Collecting Water Into the River

To echo the Liuyang River, the strategy is to dig a bay with a reduced floor area ratio in the base, and adjust the missing connection to the surrounding land. On the one hand, it improves the waterfront and helps to construct the pier. However, because the second phase center is far from the water body, the addition of water can expand the waterfront of the center and alleviate the impression of a high-density depression.

3.1.3. Restructuring Urban Centers

This project's design is not based on a blank slate, but rather on an existing pattern of adjustment and optimization, considering time, the completion of the entire area of the center in time, and the use of rail transit, among other factors. For example, the design chose to regenerate the high-density area by adding some major centers of building construction. According to the external situation, the secondary center's main and sub-center patterns will be formed during the second phase of growth around a different subway station.

3.2. Upgrading Urban Function

The general economy currently rules Changsha, and the financial sector has a small capacity, but it is developing at a good clip and is becoming a significant pillar industry (see Figure 3). As a result, we fully take into account Changsha's current industrial status quo while considering the city's financial hub. In addition to continuing to expand financial forms, we also integrate financial services into the general economy and transform them into foundational services for business development in order to ensure the growth of businesses and foster their ongoing innovation. Hunan Province's six pillar industries—construction, equipment manufacturing, steel and nonferrous metals, cigarette manufacturing, tourism, and culture—have developed quickly. By leveraging this trend, the industry helps the advantageous sectors shift from "quantity" to "quality," and from "manufacturing" to "intelligent manufacturing." At the same time, considering the requirements of financial personnel—busy work, the pursuit of a high quality of life—some special public service facilities, such as high-quality food, daycare, fitness, and other facilities are included; these facilities support the financial office-driven, mixed-use development.

3.3. Adjusting Land Use

While business offices are mostly the planned land use, the present land use is primarily a mix of residential and commercial uses. The main and sub-central areas' land-use patterns can be changed to accommodate the financial center's development requirements without significantly harming the majority of the already-developed areas. We

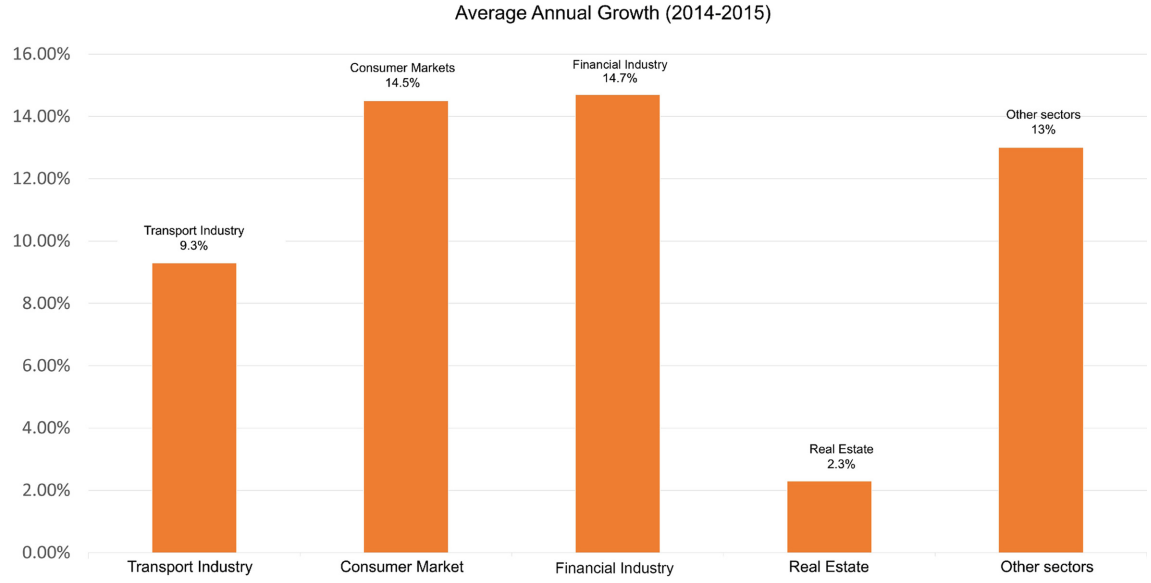


Figure 3. Industrial development analysis of Changsha. Source: Editing by the author.

have changed a few land use indicators and somewhat reduced the overall floor space ratio, due to the slow growth of the domestic economy and the abundance of offices in the Changsha area. The FAR before planning was 2.38 and the gross FAR after planning was 2.21; at the same time, the main and secondary centers are seeing the most development. The intended design can concentrate on highlighting the central area by adjustment of the existing building height. The height of the four sides gradually descends from the height of the two central portions, which emphasizes the core area.

The originally planned land is primarily residential, relatively large, and unsuitable for a financial office. Numerous drawbacks associated with high density can be lessened by increasing the density of branch roads and creating public channels between plots, thus reducing plot size. This also creates the possibility of an overall transfer in the future, in order to adapt to the growth of financial centers with the proper road network density and plot size.

3.4. Structuring Vertical Transportation

The financial center's land is mostly used for the high-intensity development of commercial and office space, and there are many jobs overall. The area is highly populated and attracts and generates traffic demand, and is more congested during rush hours. There was originally only one metro line, number 4, and it wasn't connected to the current commercial and financial hub of the main city, which prevented the financial CBD from effectively interacting with the main city. Public transit is not adequately supported, and there is not enough of a cross-river connection on the north side of Juzizhou Head, especially since the development direction was changed to be more financial-focused. The addition of Line 9 is therefore suggested to link the financial district with the primary urban region along the Xiangjiang River.

When people consider the financial center, they primarily consider two types of demand: the first is intercity business communication, and the second is the usual commute and recreational activities. Therefore, the financial center must be strengthened with a high-speed airport link, business center, downtown, and upscale residential area. Therefore, the plan redesigns Line 9 such that it passes through the financial district, crosses the river, intersects Line 1 and terminates at Line 3, so as to establish a direct connection between Yuelu and Xingma, the two significant subcenters. Besides, the design connects Meixi Lake and two premium residential neighborhoods on the opposite side of the financial center for the commuting convenience of financial professionals, and increases the rail transit volume in the area, promoting the high-density development of the land parcel.

The North Second Ring Road, Fuyuan Road Bridge, and Yinpangling Bridge connect the vehicle traffic base to the main metropolitan area. Yinshan Road and Xiaoxiang Avenue connect it to Yuelu Mountain and Xiangjiang New Town. As of this writing, there are many bridges spanning the Yijiang River in the Juzizhou area, and the areas along the river's two sides where the financial center is situated will eventually serve as the city's development hub, it is imperative to improve cross-river traffic connections. There will be two fewer river crossings, bringing the average distance down to 1.4 kilometers between bridges. To improve transportation connections with the opposite side, a subway line and a bridge across the river will be built. To direct long-distance transit traffic in the city away from this area, strengthen the traffic capacity of Yinshan Road, and lessen traffic interference from peripheral traffic in this area, a regional traffic protection circle is built using the south-north Yinshan Road, east-west Sanyi Avenue, and the second ring highway. Riverside Avenue, which is reduced from four lanes in each direction to two lanes in each direction, weakens the motor vehicle traffic function at the same time. The Riverside slow traffic corridor is created at the same time as the slow traffic function is improved and non-motor vehicle lanes are introduced.

These currently under-construction developments must be taken into account in order to maintain the slow-traffic system and the current building in the financial district. As a result, the structure, location, and mode of connection of the sluggish operating system become its keys. According to the measure of the stream of people, superposition, through to finalization of the design, determines the slow path, and optimizes the flow of people through the financial center's mainstream of people according to different purposes: commuter traffic and leisure traffic; commuter traffic with mainly on-site office space as the main destination; leisure and recreational flow, etc. At the same time, the financial center's underground area is rather complicated, including a river tunnel, a subway, a rainwater tank culvert, an underground loop, an underground pedestrian passageway, underground parking, and other composite uses. The way in which its subsurface space resources are used is equally crucial. The spatial organization logically arranges the vertical relationship of each layer, and clarifies the implementation requirements such as height, soil cover, and burial depth, using the idea of a base map.

3.5. Architecture and Public Space

The core region of the present phase includes the construction of Nanshan Real Estate, Xiangjiang IFC, Qianlong Financial Center, Yinjian Binjiang, Minsheng Bank, and Shanghai Pudong Development Bank, but these structures are unconnected and independent of one another. According to the plans, two extremely tall structures will be built to the south of the Xiangjiang IFC, surrounding the tower and forming a group of spectacular structures that will surround the lower square and the subway station hall, substantially enhancing the first phase of the buildings' appearance. In order to conveniently access the nearby

office and commercial space, the first phase's central area is connected to the riverbank using the existing green corridor, and the buildings are linked by a second-floor corridor.

Many greenways have been reserved and built in the current construction, but the current status is not acceptable; many of them have turned into parking lots and abandoned land, and some developers have even used them as underground garage entrances. On the one hand, new public spaces are added on the foundation of the original public spaces to connect the fragmented existing public spaces and create an integrated public space system, allowing these greenways to be connected with each other, and at the same time with the surrounding large mountain waterfront space. This is done in order to make these development spaces truly usable by everyone. On the other hand, we added stores on both sides and installed public art and service facilities at the end of these greenways to boost interest in walking, and to and encourage people to use these greenways.

4. Dynamic operation

The majority of the base sections are currently under construction, producing an urban structure with residential function as the basis, with financial and office uses as ancillaries. The introduction of vitality and the stimulation of regional development have become crucial tasks following urban rehabilitation. The two subway stations are currently the area's main source of liveliness. There is not enough connection to the surrounding land, and it is challenging to encourage the development of the surrounding areas, as the majority of the first phase of the subway station's surrounding areas have been completed, and the second phase of the subway station has been cut off by the bridge over the river.

In order to increase connectivity between the subway station and its surroundings through the underground space and overground corridor bridge system, the design takes into account lowering the amount of traffic on the ground. First, it considers a site that is already substantially built, and transfers to the difficulty of construction, planning a barrier-free transfer to lines 4 and 9, through a transfer station. This would have the effect of strengthening the main regional development core, connecting people working in the business district to district shopping, business, and tourism. Extensive use of the transfer station would effectively make two existing stations the core business district of the city. This design examines the relationship between subway station entrances and exits and concludes that the transfer concept can be implemented, given the construction of the Financial Center station, Changwang Road station, and the proposed addition of the Financial Center station on Lines 4 and 9. It does this by using a pedestrian scale study to determine the feasibility of the transfer concept.

In terms of building underground space, the government should take the lead in constructing the skeleton network of underground space to facilitate the passage of the underground main line, direct surrounding developers to connect with it, and integrate and enhance the planar and three-dimensional land value of surrounding land. The bus stop and subway station, which are closely connected by the pedestrian network, are the focal points of the extensive trade that is present in the underground area. The high degree of circulation increases the financial center's overall commercial value by allowing the traffic flow to naturally transition into the commercial flow. The entrance and exit to the subway are combined with the settings of the existing buildings, and it is thought to construct a sunken square on some open spaces (beneath the surrounding road arch). The main walking nodes are simultaneously set up with vertical traffic and walking corridors, and the backflow line is planned to create a stepped, streamlined structure. This will enhance the value of each floor in the building to create a vertical city along the circulation line.

The introduction of skills is encouraged, and the office environment would be made more lively by introducing proper business facilities. A reliable multi-dimensional walking system can improve the efficiency of connections between structures, transportation hubs, and open areas. In the primary walking area, an air corridor will be installed. The first phase's and the second phase's cores are connected by the main corridor. It communicates with the riverbank and connects to the cultural park that has seen industrial ruins turned into the main green corridor. It is a full system because the secondary corridors are connected inside the office space (see Figure 4).

5. Control Mechanism

To create a general control cooperation platform for joint development and construction, the urban design technical team, Regional Development and Construction Platform Company, and Xiangjiang New District Land Planning Bureau collaboratively established this project. To secure project implementation and move it smoothly to completion, the platform organizes multi-party technical coordination and cross-professional collaboration. This involves coordinating construction inside and outside the red line, above and below the ground, and moving back the plot construction from public space in order to give crucial technical support. To coordinate the stage's outcomes, enhance them, and address the issues with Hunan's financial center's protracted growth cycle, the team must tackle challenging coordination, planning and design requirements.

5.1. External Interconnection Mechanism

By integrating the platform and pertinent external partners, such as different owner unit departments, various planning



Figure 4. A bird's eye view of the Changsha Financial Center. Source: Changsha Binjiang Construction and Development Co., LTD. 20.

and design establishment units, pertinent government departments, and inspection and approval agencies, effective and accurate coordination may be achieved.

Unified strategy, technical background. The project team will suggest technical support materials for various design accomplishments and transmit them to the relevant design units through the Binjiang Company and the Land Planning Bureau of the New District Management Committee.

Standardized procedure, exclusive usage list. For the sporadic technical coordination meetings, project review meetings, and other meetings, the project team standardized the procedure, created a list of special work contacts, and created meeting minutes. The project materials consulted by the Binjiang Company and the Planning Bureau of the New District Management Committee were organized and filed through the use of the special work contact list and meeting minutes to create a database for regional projects.

5.2. Internal Interconnection Mechanism

A complete set of internal working mechanisms has been developed by drawing on the knowledge of other cities' planning, design, development, and construction management, as well as the construction requirements of Hunan's financial center.

An ideal management system. The platform has established a standardized and procedural working mechanism and actively responded to give technical and transactional work assistance for the owners through close communication with the owners and the promotion of the project status.



Figure 5. Perspective view of the Changsha Financial Center. Source: Changsha Binjiang Construction and Development Co., LTD.

An effective working style. The team creates a thorough work schedule, establishes the structure for the task, and promptly shares information on important concerns. The accountable individual for each specialization will resolve any conflicts during the meeting.

6. Conclusions

Due to changes in urban growth and positioning, many high-density urban regions currently require adjustment and development. However, because of these high-density characteristics, it is challenging to accomplish the goal using only one or two methods. Through a series of urban renewal projects, it is necessary to use the three-dimensional city concept and methodology in order to address the original shortcomings and infuse new vitality. However, this can only be done after a thorough examination of the current issues, comprehensive planning for space, business models, and transportation, and the addition of efficient mechanisms and measures (see Figure 5).

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