

## **Analysis and application of mountainous city profile methodology. A case study on Yuzhong Peninsula of Chongqing**

**Zhu Mengyuan, Leng Jiawei**

Southeast University, Nanjing, China

E-mail: lorily123@sina.com, 2395524131@qq.com

**Abstract.** *Established in the thesis of urban morphology, this essay focuses on morphological analysis and space research in urban scale by employing the methodology of city profile ,hence providing a new perspective of urban design on mountainous city. In the case study of Chongqing, the profile line is selected covering the range from riverside park to Hongyadong historical district and the surrounding areas. Reticular formation is applied for comprehensive analysis on space construction and humanity system of the sequential city profile. The final target is to provide theoretical foundation for urban design with regional features, according to prototype extraction of main blocks.*

*Keywords: Urban morphology, city profile, mountainous city, urban design, theory research*

### **Introduction**

Contemporary research on urban morphology usually concentrates on two perspective: synchronicity and diachronism, both of which are established on planar analysis. When these theories are applied to mountainous cities, it will emerge errors in research of urban social space. For this special kind of city quite different from plain city, analysis on one perspective in figure-ground relation will have limitations, considering the complications of urban structure and environment. The Theory of Architectural Typology by Leon Krier explains that the city should be considered as a growth tissue and its basic unit should be every block in the city. The focus in research should be reduced from a huge block into a human scaled one. It is widely acknowledged that urban space is formed with two component factors- physical space construction and residential culture . space environment construction includes the land-use pattern and functional decomposition, while residential culture covers history , Folk-custom Scene and citizen quality. As a result,

this essay will explain these two factors on the basis of vertical analysis of the city profile mentioned above.

### **Methodology**

#### **Concept for City Profile Methodology**

Putting an imaginary plane in a particular urban space, cutting the block, building, facility around this cut line and then we can get the interface, in which we can also find the residents' social and cultural properties .we call the interface or the sectional picture as the City Profile. The City Profile can faithfully reflect the continuous and gradual change of the selected regions, thus obtaining the characteristics of the timeliness and spatiality.In a city profile, the imaginary cutting plane could be a road throughout different blocks. More details, including block scale, building form, open space and chaotic street life nearby, could be recorded in the interface. Once the selected road is a continuous gradual change line, the city profile could represent the characteristic of synchronicity and diachronism.

**Reason for sample selection**

The sample for city profile should satisfy the demands below. Firstly, the city should hold typical characteristics of mountain topography. Secondly, the city covers adequate kinds of active blocks for model extraction. Thirdly, the city's urban dimension and architectural composition is deeply influenced by mountainous terrain. This essay will demonstrate the application for city profile in Chongqing, which is the central city in southwest China and also a well-known mountainous city. The cutting line will cover a range from riverside park to Hongyadong historical district, including Shibati residential district and Jiefangbei central business district.

**Research method****Foundation of Urban Morphology**

A city's components, not only physical part or social humanity part are constructed in a rather complex system with complicated variable rules. regardless of which kind of culture or landscape, a city is made up of "element" and "composite structure of elements", which are also the key point of the essay. Another important theoretical foundation of this essay is the Theory of Architectural Typology, which believes that urban analysis can be employed in two steps- type selectivity and type conversion. The essay is emerged from this method and unfolds over several steps. the first step begins at analysing and synthesizing the urban space in "element part" and "composite structure part of the element", which is devoted to prototype extraction. The next step is making translation on prototype extraction and summing up design experience. The last step is applying this method to urban design in a specific city with adequate considerations for modernization construction and regional features.

**Research element for Mountainous City Profile Methodology**

City profile study takes block as the basic unit, which embodies urban space integrity. The interface emerges after the cutting of a city block, which can be resolved into bottom interface, perpendicular

interface and top interface three levels. Details and information on the interface represent the present status of a city and will be analyzed. Bottom interface demonstrates the relationship between site and foundation, including natural and manmade terrain, landscape, Living riverbank which not only bear the weight of various outdoor public activities, but also reflect the level of urban construction, regional characteristics and specific culture. AS the most important part, perpendicular interface concentrates on space between different buildings, for example, the physical space for buildings, streets, public squares and so on, which impact the block atmosphere with community vitality. The top interface displays the building skyline, which is related to the roof form and building height, showing the comprehensive features of the block.

**2.3.3 Composite structure of element**

This essay is developed from two main theories. On the one hand, Alexander R. Cuthbert holds the opinion that internal diversity between different districts is the result of long time urbanization, showing a continuously varied structure. On the other hand, it is widely acknowledged that urbanization process is consist of landscape urbanization and humanity urbanization (population growth and citizen diathesis). Study on composite structure will be established in construction principle and differences on landscape and humanity urbanization.

**Case study and analysis****Selection reason for Chongqing**

Located between two rivers (Yangzi river and jiangling river) with various kinds of landscapes and long history, Yuzhong peninsula used to be the centre of main Chongqing. The street and house distribution are greatly influenced by the mountainous topography, especially zones from Shibati to Hongyadong historic conservation district. The region for case study has four kinds of blocks belonging to different urban fabrics and landscapes of a mountainous city, with relatively high theoretical research value. the General Plan of the research is shown in figure 1 below.



Figure 1. the General Plan of the case

### Feature of selected case

Generally, on both sides of the city profile, the landscape belongs to are riverfront areas with broad vision but high density of buildings. At the same time, the Shibati old district remain the original texture of old zones ,where buildings here are constructed with self-reliance and operated independently without planning. As it moves toward the center district called Jiefangbei CBD, high buildings stand up like a forest, traffic is crowded and green land is reducing.

### Riverfront park block

#### Landscape urbanization

The bottom interface shows the feature of riverside green space with ecological environment and artificial public square interpenetrating and interacting into each other. In the city profile, we can see three levels from riverine wetland, riverside park to city express way, with a height difference of 8 meters and 19 meters. Along side the river, there are a lot of small scale exercise yards and shipping wharves, where the available space are closely affected by ebb and flow of Yangzi river. The perpendicular interface mirrors the building

distribution of the shipping company and its warehouse in low density. On account of the larger vehicle flux and drivers' requirements for food and daily necessities, there are many stores and restaurants along the express way and under the viaduct. The top interface presents a clearly decreasing trend in the skyline.

### Humanity urbanization

As a main port and inland city of China, Chongqing's economic growth is primarily driven by logistics. limited by the mountain and terrible land traffic, shipping on Yangzi river used to be the main traffic route for commercial transportation before rail transport being popularized in 2010. Although affected by the impact of rail transport, truck transport and air transport, which are considered better than shopping in efficiency and price, Shipping still plays essential role in commercial transportation and especially, tourist industry , benefiting from Cruise Tour in Three Gorges tourism. Unfortunately, more remarkable, the operating frequency and quality for riverside green space are not good with obstacle of the express way and viaduct.

### 3.3.3 Prototype extraction

In conclusion, the riverside space with excellent landscape as well as uninterrupted views of both city and natural beauty can be transformed into public parks in four patterns, tidal flat, dyke, multi-layer dyke and square in stairs(Figure 2).

#### Riverside residential block

##### Landscape urbanization

The bottom interface obeys the geomorphic feature of flatland with a relatively flat slope. In the perpendicular interface of the profile, there are high-rise buildings with business stores on ground floor, straightly open to the express way and back against the cliff. In area far away from the riverfront park,

quantities of old-fashioned multiple floor residence increase, most of which are in brick-concrete structure. What's more, there remains some traditional vernacular pillar-supported dwelling in wood construction and this kind of construction is also a main architectural style with centuries-old history in southwest china. In the top interface, we can find that, high-rise blocks are far enough together for more public green space and less shadow, but old buildings remained are close together, leaving space just for walkable streets. The skyline first increases sharply in high-rise buildings, but declines gradually as moving inland towards old residential areas(Figure 3).

##### Humanity urbanization

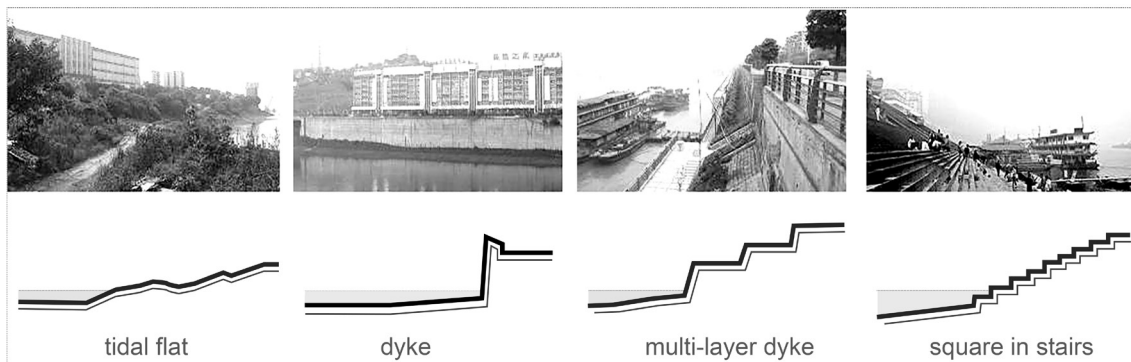


Figure 2. prototype extraction for riverfront park

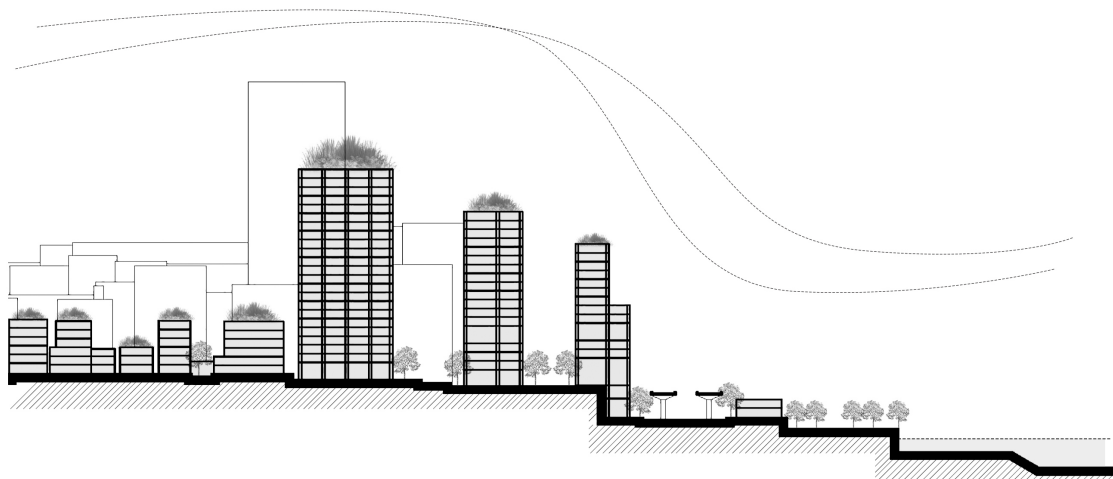


Figure 3. City profile of riverside residential block and Shibati residential district



Subject to commercial reasons, national defense regulation and the demand of Modern building principles, high-rise buildings located near the river with best views pursuit of high volume rate. In old residential areas, where available land for construction is narrow and have quit a lot limitations, most self-established buildings belong to neighborhood committee and have not been function replaced and updated. The requirements for adaptation for local topography and resolving problems on lighting and ventilation impact the final shape and feature of these residence houses.

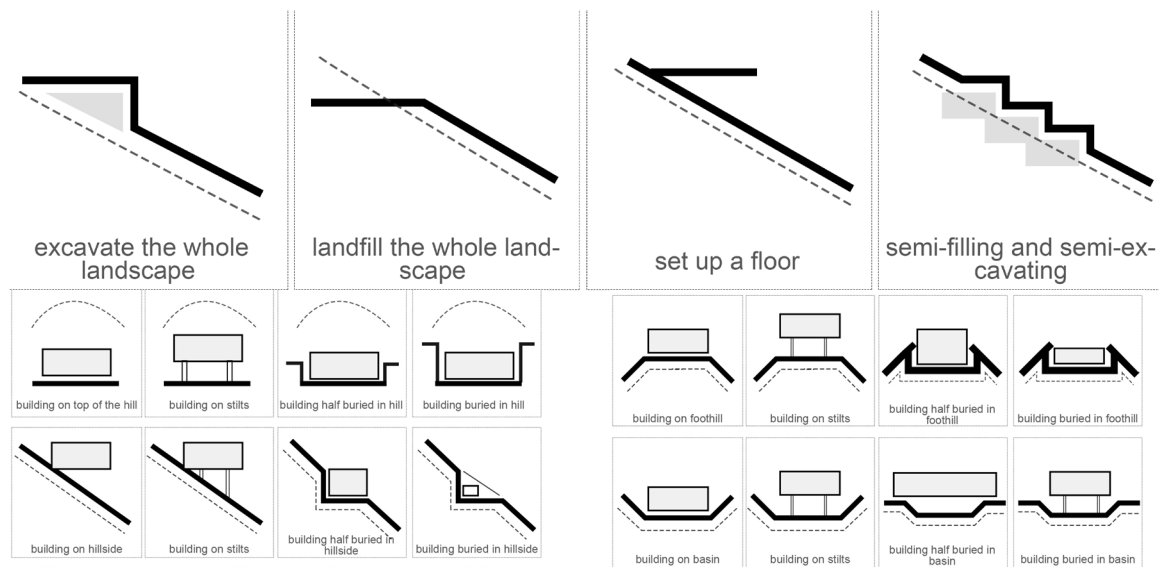
**Prototype extraction**

In general, the block landscape has been transformed by artificial excavation and reconstruction according to natural topography in four ways. In area where high-rise building stands, the whole slope is excavated and filled totally into flat land for foundation. For small cottage and ordinary multi- storey residential house, which are usually constructed in steep and broken mountain, methods of semi-filling and semi-excavating are to be employed. Another popular choice is learning from experience of vernacular pillar-supported dwelling and making little change on the original landscape. When it comes to the combination of buildings and terrain, we extract 16 kinds of prototype and they are presented in figure 4.

**Shibati residential district**

**Landscape urbanization**

The bottom interface is similar to basin space, where the main part is depressed as the boundary is increased gradually to the same height of the peripheral region. This block is constructed along a walkway in steps with a height of nearly 18 meters and a length of 300 meters, which is the closest path for pedestrians to get from the foot to the top of the hill. The perpendicular interface of the profile expresses the scene of busy daily street life along the path. Buildings distributed among the path are almost two and three story houses with sloped roofs, most of which are faced to the path. The function of these facade are stores dealing with community service and retails in the same styles. These stores and residential buildings remain a little weathered as it being constructed and still follow the principles including four items :variety and unification, scale and dimension, rhythm and cadence, balance and unbalance. The styles and scales of the constructions vary quit a lot ,making the whole path clutter and confusion. Public space, like some courtyards and alley-ways, is the most active part of this block ,most of which are in a size of 4 to 6 meters, where the old and young can wash and drying weather under the tree, the residents and tourists can enjoy majiang game and snacks here. The top interface shows a picture that the skyline is relatively flat with traditional tiled



**Figure 4. prototype extraction for transformation of landscape**

roof, compared to the high buildings and large mansions nearby.

### **Humanity urbanization**

The walking path of Shibati used to be the only connection between the old town and the top CBD block for pedestrians and witnesses the urban transformation of Chongqing, regardless of little impact from modern vehicles. The large influx of people and their demands for living and leisure supply have brought prosperity to the district. However, Shibati rapidly declines in modernization process due to the bad traffic and complex property relationship.

#### 3.5.3 Prototype extraction

The landscape and architecture form are quite similar to old residential block, so we can follow the same reference after adapting to the local topography.

### **Jiefangbei CBD block**

#### **Landscape urbanization**

The bottom interface shows the typical characteristics of flat space while the height near jialing river declines slightly. Jiefanbei CBD block is the earliest, biggest central business district of Chongqing and this area is built under modern planning at the beginning. The perpendicular interface presents this characteristics clearly. The building annexes under 24 meters are in service for pedestrian street and retail commerce, while the towers on the are in the function for financial offices or luxury hotels. Blocks and architectural layout follow the same principles with similar features, only parcel areas are flexibly constructed. Buildings in huge volume generally gather at

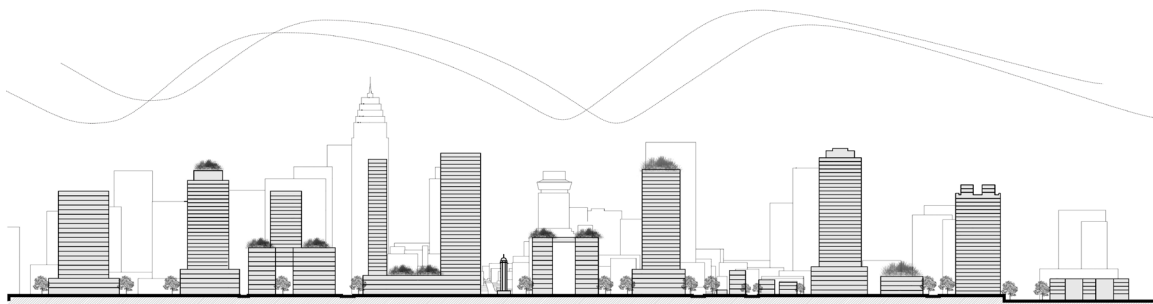
the field with large construction density and small spatial scale. Most high-rises stand back to the annex, thus leaving more space for roof garden and reducing the sense of oppression for pedestrians. In the middle of this block is a central square where the Emancipatory Tablet stands and this place is also the central and symbol for main urban area of Chongqing. There are also several little grounds dispersed around the Emancipatory Tablet in a distance of 100 to 200 meters away from each other. On account of abundant architectural details, elevations and roof forms, the top interface have plentiful stratifications(Figure 6).

### **Humanity urbanization**

Jiefangbei CBD is the result of modern urban planning, whose block scale, shape and characteristic are all under the same principle to suit the demand for motor traffic, leading to the loss of adequate possibilities in free development. Fortunately, preferences and develop conditions of different owners make efforts to a more changeable block.

#### 3.6.3 Prototype extraction

How to create neighborhood and enhance street vitality is always the priority target of this kind of modern block and generally there are three patterns : street under motor vehicle guidance, street under pedestrian guidance and street under guidance for coexistence of people and vehicles. Since there are a large number of similar studies on modern block construction in theory and practice, this essay will do no further discussion.



**Figure 5. City profile of Jiefangbei CBD block and Hongyadong historical district**

## Hongyadong historical district

### Landscape urbanization

The bottom interface reproduces the cliff landscape with a height of 100 meters. The upper part of the block is a abrupt slope in 70 to 80 degree, while the next part is a rather flat slope in 30 to 40 degree. The original buildings here are vernacular pillar-supported dwelling in wood constructions. The transformation and protection project remains the structural style but change the material into steel and concrete. The whole historical block is formed with several small buildings and looks like a huge architectural complex, which can be clearly seen in the perpendicular interface. To enrich the building image with a large volume, more construction skills in traditional residential house are adopted, including setback, split-level and overhanging and each house is equipped with sloping roof. As buildings blocking most landscape and composing the side space of jiangling river coastline, the top interface mirrors a distinctive sense with rich levels of roofs, flat form, green garden and pedestrian walk path.

### Humanity urbanization

After the renewal process of Hongyadong, this block has already abandoned its original function concerning residence and casual living. Urban designers apply new functions such as restaurant , tourism and trading on small commodities to this block to attract more people and investment.

### Prototype extraction

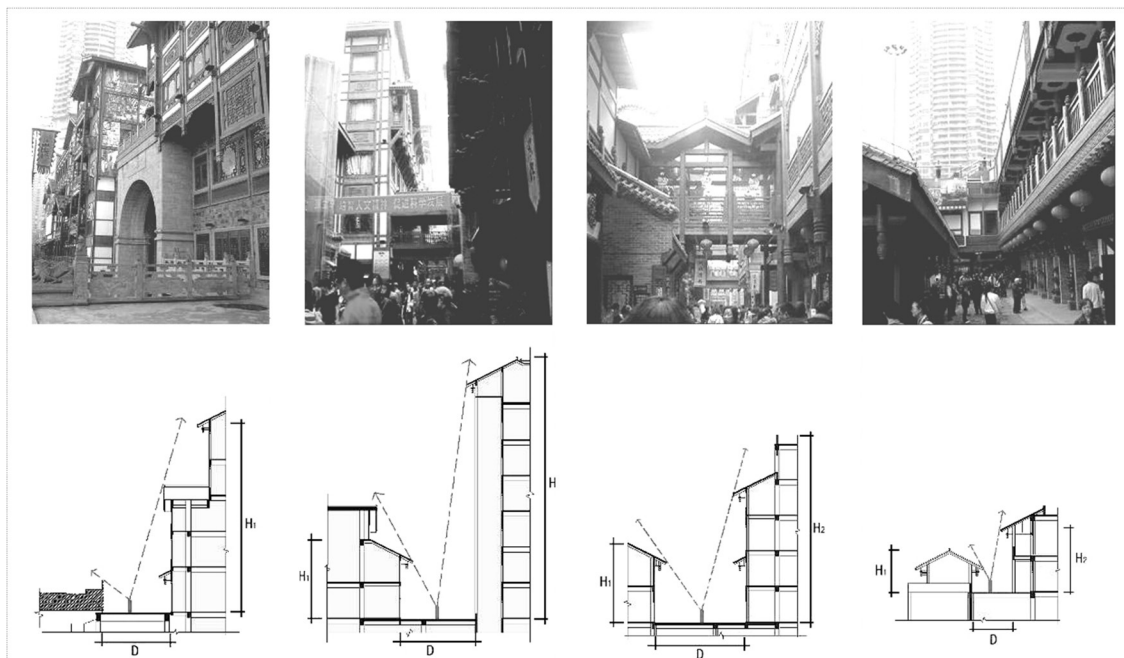
Street becomes the main part for community vitality and four patterns(Figure 6)can be extracted after the research.

### Conclusion

### Application principle for City Profile Methodology in urban design

Design should concentrate on requirement for nature and citizen. More attention should be paid for natural landscape and Reduce the reconstruction of the topography in large scale. Due to various living habits and folk cultures of different people, more research and analysis on citizens' social psychology,behavior character and aesthetic judgment should be employed before actual construction steps.

### Processing strategy on a specific block



prototype extraction for Hongyadong historical district

**Figure 6. prototype extraction for Hongyadong historical district**

**Riverside residential block**

The key issue for mountain residential district emphasizes on the foundation settlement and entrances and exits on ground floor. Most of the activities emerge near the traffic node, which helps creating the community vitality, so more public facilities could be set on the ground floor. The underground parking have clear and straight access to gymnasium , swimming pool, BBQ area, children playground and outdoor fitness area. Considering the limitation of available land, high-rise tower could be set back for more terraces on the roof.

**Riverside green park**

On behalf of the beautiful scenery, more greening park and open space should be built and let the greening integrate into city land. For park with high altitude difference, more guard bars should be built around dam and reduce obstructions that block the river sight. For intertidal zone ,more steps and water docks equipped with teahouse and stores would be appropriate, making advantages of ferry terminal and tourism ships.

**Jiefangbei CBD block**

The sense of order and dimension do work in enhancing the feeling of well-being and positive relationships in CBD .There needs a the landmark or square should in the central and the surrounding areas should not exceede the scale and height of the symbol.

**Other points**

More considerations about the complexity of mountainous city should be taken into considerations in urban design as dealing the whole city as a overall issue. Blocks with different features are to be designed in relevant solution separately. While at the same time ,how to deal with the connected regions and boundaries become important if we want to avoid feature mutation and confusion. Regulations should be followed to point out the emphasis area, second-emphasis, common area and other area.

**Disadvantages**

Although the City Profile Methodology remedies of limitation of plane in urban

design in a more intuitive and simple way. It just provides an illustration means in vertical design. It can not afford precise information on urban humanity, historic content and geographic ecology, which also make a difference to the final result. Limited by the author's own academic accumulation and lack of experience in specific research of the case, this essay need further investigation and practical feedback in future.

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