

The study of public escalator/elevator and its surrounding as a micro-urban form on a hillside city

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Abstract

In order to overcome the hilly nature of the terrain, public elevators and escalators are unique civil transportation of a hillside city. These are generated from the urban morphology of the sloping land, and feedback affects the micro-city morphology in their surroundings. Among them, the Kaixuan Road elevator and the Huangguan escalator in Chongqing city are the main research objects in the study. The purpose of this study was to analyze the interaction mechanism between public elevators and escalators and sloping urban forms. The Urban traffic analysis, historical city plan analysis, and 3D modeling were applied in the study. (1) Urban traffic analysis: Through the GIS urban topographic map, the urban form of Chongqing based on the sloping terrain is analyzed, including its transportation network structure and built-up landforms. Then it analyses the location and reasons of the plots of public escalators/elevators and obtains the macroscopic impact of terrain on the city. (2) Historical city plan study: Based on the analysis method of M. R. G Conzen's urban morphology theory, the paper studies the changes in the urban environment around the two cases in Chongqing, including the aspects of urban land, building types, street shapes, architectural shapes, people flow, and public space interfaces. (3) Through 3D modeling to analyze the spatial impact of the announcement elevator escalator on the surrounding city. The conclusion of this paper reveals the changes and impacts of public elevator escalators as an infrastructure in the urban development of Chongqing city, finding the influence mechanism between public elevators/escalators and urban forms in sloped cities.

Keyword: Micro-urban Form, Hillside City, Civil Transportation, Elevator, Escalator, Chongqing City

Introduction

The subject of this thesis is how urban public elevator escalators are created and utilized as an infrastructure in the urban developing process, and what impact it has on the surrounding urban form.

The challenge of studying micro-urban morphology on hillside city

Urban morphology as well as urban planning practices often study and design the morphology of cities in the form of plan maps, which are relatively difficult to study regarding the morphology of sloping cities. There are a large number of historical studies that provide many original plan maps of Chongqing to provide a basis for following M.R.G.Conzen's approach to town map studies. However, because of the special characteristics of mountainous cities, it is necessary to intervene in elevation studies to describe their special urban morphology. By the same token, sloping cities are more difficult to build and relatively backward in infrastructure construction compared to cities with a gentle topography. This thesis builds a bridge between

the special infrastructure and urban morphology in mountainous cities and tries to explore the mechanism of its interaction with urban planning.

Innovation of this article

The research in this paper combines GIS technology to restore the current urban three-dimensional space and a large number of historical maps of the town in an attempt to simulate the process of change of urban morphology around the public elevator escalators in the city. First, the historical maps and documents are used to understand the formation process of Chongqing as a mountainous city and the position of the two urban public elevator escalators in it and its changes. Second, topographic maps, road network maps and road elevation differences of Chongqing's built environment were obtained through GIS software and data from the National Geographic Center to understand the spatial relationships, plot functions and road slopes of the built environment. The three-dimensional modeling was also used to understand the connection relationship between the public elevator and the surrounding city, as well as the three-dimensional shape of the surrounding micro-urban form.

Following a macro to micro research structure, this paper first describes and analyzes the formation process of Chongqing city, focusing on elements such as topography, city boundaries, and roads, to understand the location of the research object of this thesis in the whole urban development process and the reasons for its generation. Then we analyze the traffic movement, plot functions, topographic relations, and the connection between the urban public elevator and the surrounding area within one kilometer of the research object as the center. The final orientation is the influence mechanism between the top-down urban construction and the bottom-up self-organization.

Background

A brief description of the urban development process in Chongqing

In the eastern part of the Yuzhong Peninsula, there are two relatively gentle areas from south to north from the Yangtze River: the under the half city (at the hillside location), which is an average of 50 meters above the river's surface, and the upper half city (at the hilltop location), which is an average of 120 meters above the river's surface.

For a long time, because of the topography and history, the city of Chongqing mainly developed along the north bank of the Yangtze River. People lived along the river, creating a pattern of separate upper and lower halves of the city. By the beginning of the 20th century, the basic pattern of separation between the upper and lower halves of the city was not significantly different from the time when the city was established. However, after the 1940s, as industrial development promoted the modernization of the city, Chongqing's city limits were further expanded and the centre of the city shifted from the under the half city to the upper

half city. Although the construction of roads connected vehicular traffic between the upper and lower halves of the city, the 40-80 meters height difference between the upper and lower halves of the city still made it difficult to walk.

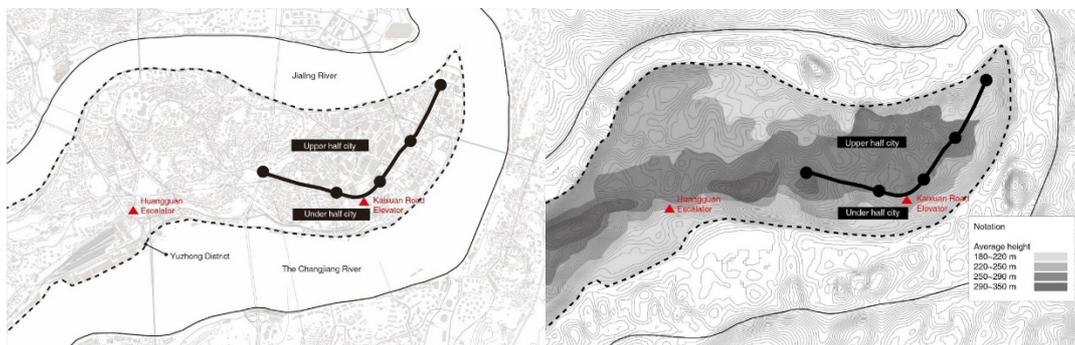


Figure 1. Current map of Chongqing Yuzhong District. (Self-illustrated by the author)

Figure 2. Current topographic map of Chongqing Yuzhong District. (Self-illustrated by the author)

Background of Kaixuan Road elevator and Huangguan escalators

The history of the Kaixuan Road Elevator goes back to the completion of Kaixuan Road. Kaixuan Road is the main road connecting the upper half city and the under the half city, which was started in 1940 and completed in April 1942, taking the meaning of "triumphant return from the war". It connects Chuqimen to the river and Xinhua Road to Jiefangbei, which was the main road in and out of the city in the modern era of Chongqing. Because of the significant difference in the height of the terrain, Kaixuan Road can only be attached to the mountain in a Z-shaped winding, and Kaixuan Road Elevator is located at the bottleneck of the city connection at the most significant point of the difference in the height of the Z-shaped road. The construction of the Kaixuan Road Elevator was started on January 1, 1985, and put into trial operation on March 30, 1986, which is the first urban public elevator in Chongqing city. It has rewritten the vertical mobility experience of the citizens of the mountain city as a unique infrastructure for the mountain city. Although it is still in use, people now rely more on car travel, resulting in a current decline in patronage. However, as a fresh experience for a mountain city and a historic preservation building, the number of visitors increases year by year.

The historical background of the Huangguan Escalator is closely related to the Caiyuanba Railway Station in Chongqing. The Caiyuanba Station was completed and opened in July 1952, and it was one of the stations of the Cheng-Chongqing Railway, the first railroad built after the founding of New China. Caiyuanba Railway Station is located on the south side of the lower ground. In order to connect the railway station with the upper half city, the government built the Liang Lukou Rack Rail in 1953 to connect the Liang Lukou area in the upper half city, and this cable car was the predecessor of the Huangguan Escalator. After its renovation in the 1980s, the Liang Lukou Rack Rail carried 58,000 passengers a day and was one of the important means of transportation in Chongqing at that time. As the second-longest sloping escalator in Asia, the

Huangguan Escalator, completed on February 18, 1996, began operation while the Liang Lukou Rack Rail was dismantled.



Figure 3. Current photo of the Kaixuan Road Elevator. (source: <https://wantubizhi.com/pic>)

Figure 4. Current photo of the Huangguan Escalator. (source: <http://cq.people.com.cn/n2/2020/0921/c367668-34305723.html>)

Methodology

The two main methods employed in this thesis are those dealing with historical maps and those dealing with current map data. In the former, a series of historical map data needs to be collected in advance as preparation. The location of the target objects and the process of road network changes are then found on maps over time by using reference points such as historical buildings, ancient city walls, and road relationships, which are relatively constant elements in the development of the city, as benchmarks. For the latter, the outlines of OSM roads and buildings are obtained through OPEN STREET MAP, and then the DEM elevation data of the specified areas are obtained through the National Geographic Centre website and then they are imported into the GIS respectively. The contours and road elevations, plot boundary lines, etc. are finally obtained through operations such as the contour command. In addition, the elevation positions of buildings, city roads, and elevation data can be obtained by linking them for specific 3D modelling.

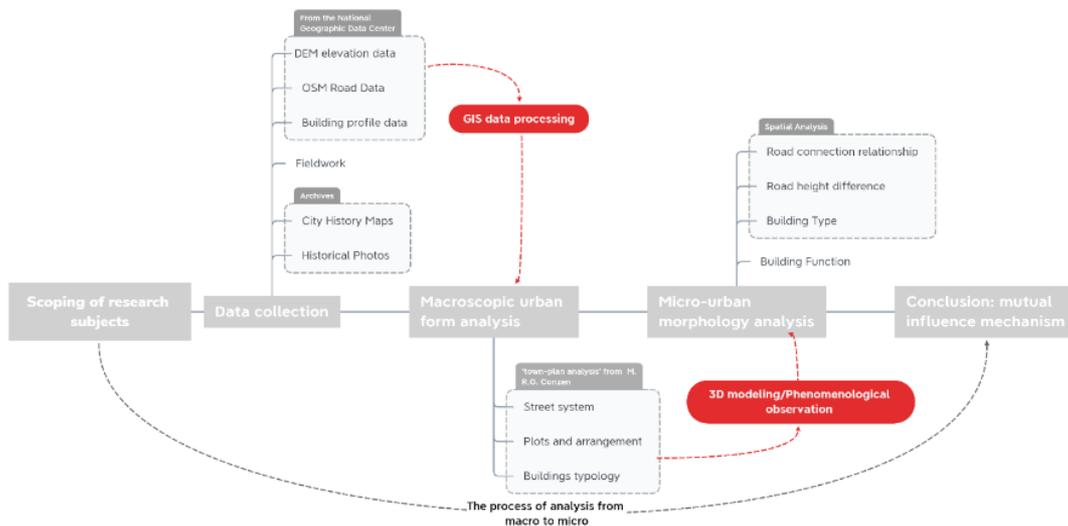
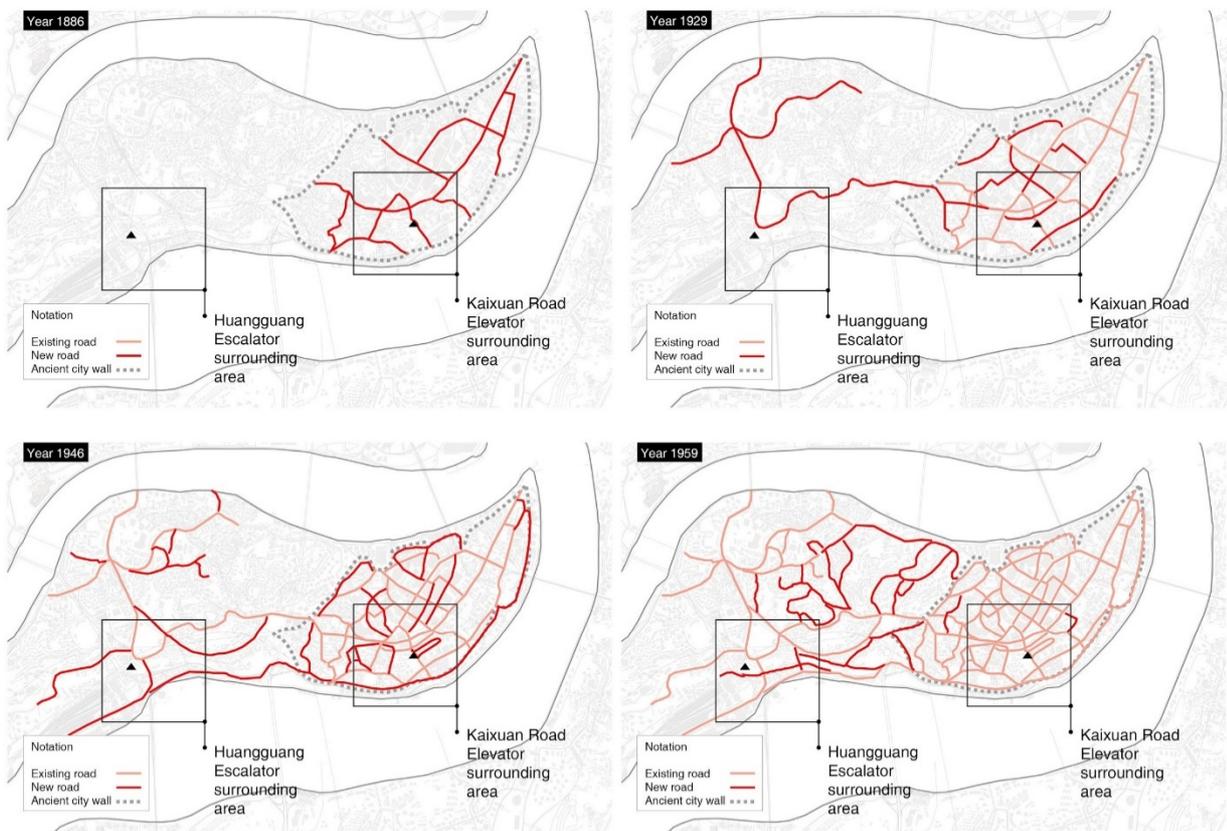


Figure 5. Methodological framework (Self-illustrated by the author)

Results and Discussions

The study uses road changes on historical maps to derive the trajectory of Chongqing's urban development and the key position of public transport in the two cities. The city of Chongqing, which originated in the Yuzhong district, maintained a relatively constant urban form from the Qing dynasty to the early 19th century, with a protective system of city walls forming the boundaries of the city and a topographic division between the upper and lower halves of the city. The upper half of the city, such as the Liberation Monument, began to flourish and the central city shifted to the upper half of the city. In the 1940s, the old city walls were no longer visible in the city due to the increasing size of the city, and they lost their role as the city's boundary. In the 1950s, due to the development of the Chengdu-Chongqing Railway, the Caiyuanba Railway Station became a cross-regional connection point, and the Liang Lukou Rack Rail (the predecessor of the Huangguan Escalator) was created with the railway station in order to allow a large number of people from the station to reach the upper half of the city easily. 1959 The main road pattern of the city in the Yuzhong district was largely set, with subsequent construction projects mainly an internal refinement of the road network and pedestrian system (such as the Kaixuan Road Elevator and the Huangguan Escalator), and extensions to the outside to include several cross-river bridges linking other areas.



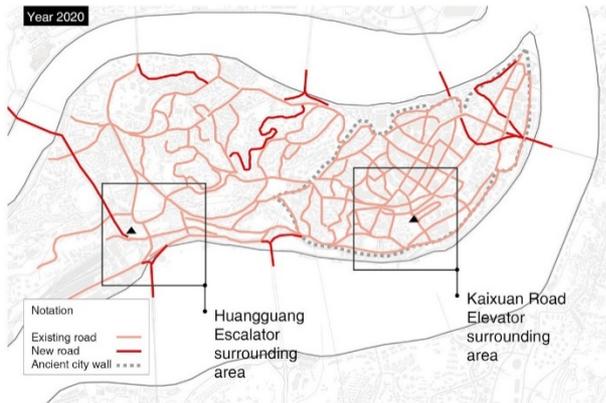


Figure 6. Urban Road Development Maps (Self-illustrated by the author)

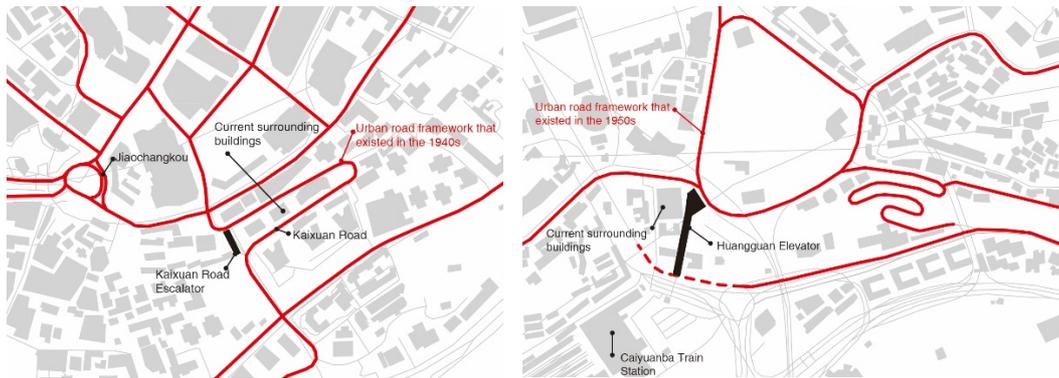


Figure 7. Master plan of Kaixuan Road Elevator and Huangguan Escalator in equal scale. (Self-illustrated by the author)

The current road in the area around the Kaixuan Road Elevator maintains the same framework as when Kaixuan Road was built in the 1940s. The word Kaixuan Road swirls upwards, with a pedestrian stairway through the roadway bridge connecting the almost 40m connecting bottleneck of Kaixuan Road. With the completion of the Kaixuan Road Elevator, the retaining wall under the bridge was not a direct street façade, but a series of new houses erected to the south of it, and the bridge opening became a kind of 'inner city' interface, once privately occupied. From the 1980s to the present day, the buildings have undergone several rounds of renewal, with the east side of the lift on Kaixuan Road changing from low-rise buildings to high-rise commercial offices, while the west side is dominated by a number of multi-storey residential buildings dating from the 1980s. The original road structure is obscured by the high-rise buildings, so one does not feel the continuity of the city as one transition between the 40-metre height difference via the lift, but rather a collage.

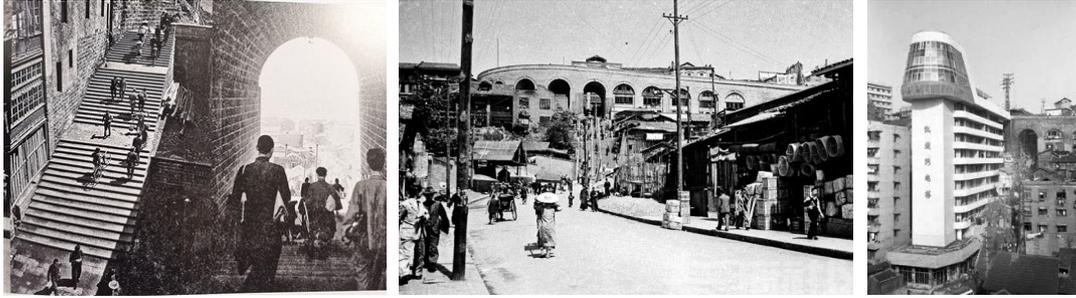


Figure 8. Old photos of Kaixuan Road Elevator's surrounding area. (Source: Chongqing Design Institute Co.,Ltd.)

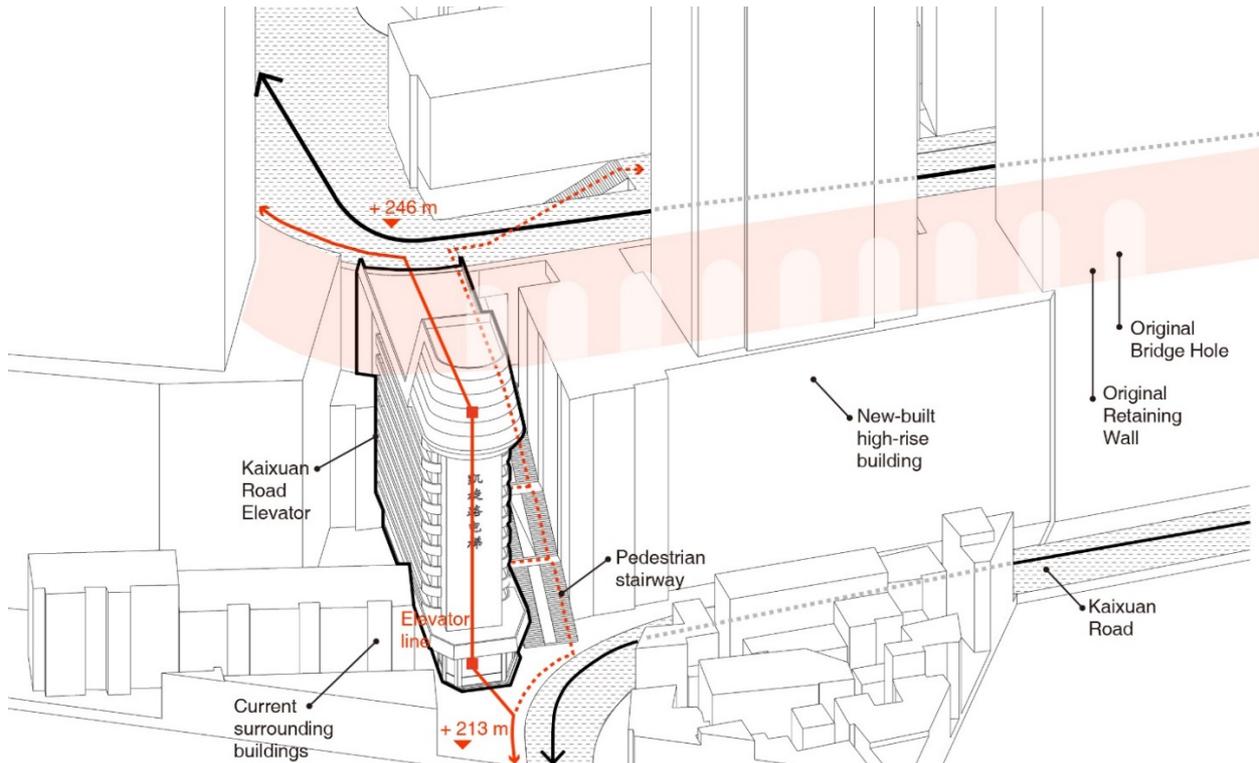


Figure 9. 3D model axonometric drawing of Kaixuan Road Elevator. (Self-illustrated by the author)

From the only historical photographs available, the Huangguan escalator, although 'inheriting' the function of Liang Lukou Rack Rail at the same gradient and location, in fact, represents a 'hiding' and internalisation of the infrastructure within the urban architecture. It is internalised in the high-rise building in which it is located, and is linked to the railway station and metro station to form a kind of internal mountain public space.



Figure 9. Old photos of Huangguan Escalator's surrounding area.

(Source: <https://www.cqcb.com/entertainment/2018-08-16/1026794.html>)

Conclusions

This thesis explores the urban development process of Chongqing's Yuzhong District and the position and influence of the city's public escalator and elevator in it, and reveals the reasons for the emergence of the two civil transportation in the macrocosm and their impact on the surrounding urban form, with the Kaixuan Road lift and the Huangguan Escalator forming a new urban interface and internalised public spaces.

Acknowledgements

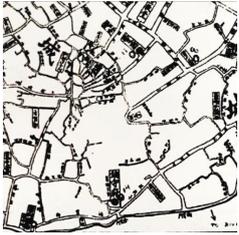
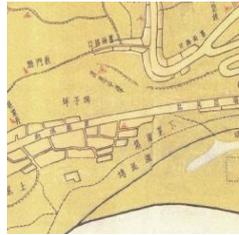
The research was sponsored by the National Natural Science Foundation of China (NSFC) project (51778421).

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APPENDIX 1

Table 1. Table Micro local city map of Surrounding urban area of Kaixuan Road Elevator and Huangguan Escalator.

	Surrounding urban area of Kaixuan Road Elevator	Surrounding urban area of Huangguan Escalator
Map of 1914		The urban area was not yet developed to this are at that time.
Map of 1920		
Map of 1937		
Map of 1946		
Map of 1950		
Map of 2021		