

Research on Urban Space Construction Strategies under Viaducts in Changchun

Bei Wang

Jilin Animation Institute, Changchun, 130000, China

Abstract: *With the development of urban transportation in China, the space under the viaduct, as one of the important forms of urban space, begins to receive more and more attention from scholars. At present, the utilization of the space under the elevated bridges in China is still in the exploration stage, and the utilization of the space under the elevated bridges is still not fully explored, and the full utilization of the space under the bridges is of great significance to improve the efficiency of land use. Based on the review of cases and from the perspective of spatial function, this paper conducts an in-depth study on the spatial form under the urban viaducts in Changchun area, and proposes the idea of setting up a vegetable market under the viaducts in Changchun.*

Keywords: *Urban Space; Construction Strategies; Under Viaducts; Changchun*

1. Introduction

With the gradual increase of urban scale, transportation facilities such as viaducts have increased. The space under the viaducts (hereinafter referred to as under-bridge space) inevitably arises along with the construction of viaducts. The number of under-bridge spaces is large and widely distributed, but they are not fully utilized due to factors such as bridge cover, vehicle traffic and scattered land use. At present, China's under-bridge space mainly exists space waste, unclear ownership, use of a single form, space gray depression, lack of planning problems. Although some cities have introduced bridge management regulations or methods, but how to use the space under the bridge is rarely involved. These unique spaces, which rely on the bridge structure to form a certain sense of enclosure and are closely linked to the public's movement, have the potential to be transformed into spaces suitable for stopping and generating more interaction, especially in urban areas with high development density, making full use of the space under the bridge is of great significance to improve land efficiency.[1]

Developed countries started to pay attention to the utilization of under-bridge space earlier and have achieved a series of practical results. Especially, developed countries such as the United States, Japan, Canada, Australia and other developed countries, organized by the government or social groups, have carried out different scale, permanent or temporary practice of under-bridge space utilization in the central or non-central areas of the city, making the under-bridge space revitalized. In this paper, based on the review of case studies, the spatial form under the urban viaducts in Changchun area is studied in depth from the perspective of spatial function.

2. Spatial characteristics under elevated bridges

2.1 Distribution characteristics

Urban viaducts are an important part of urban three-dimensional transportation and play a vital role in relieving urban traffic pressure. Urban viaducts usually cross valleys, rivers, roads, other low obstacles and densely populated central cities, presenting a large span, continuous, linear road space. Viaducts intersect with urban surface roads in vertical space, forming the under-bridge space.

2.2 Space type

Due to the constraints of the bridge body, the space under the bridge can be divided into two categories: intersecting space and parallel space, according to the relationship between the viaduct path form and the urban space below. The intersection type under-bridge space is characterized by the intersection of the bridge path direction and the main traffic direction under the bridge, which is formed at the intersection

of the bridge due to the topographic changes under the bridge, or the bridge body crossing the water body. This type of space is small in area, point-like distribution, often located between the slope roadbed, in addition to meet the basic traffic function, can be combined with the slope of the roadbed for design.[2]

3. Literature Review

Urban viaducts originated in foreign countries, for example, the construction and research of viaducts in the United States, Japan and the United Kingdom are much earlier than those in China. The Boston Viaduct in the United States and the Griffry Hill Overpass in the United Kingdom are typical cases. The author has sorted out the space under the viaducts in these countries and regions, which basically can be classified into the following categories: the form of municipal greenery under the Boston Viaduct in the United States, the form of municipal facilities and some buildings under the Griffry Hill Viaduct in the United Kingdom, the form of commercial under the Nakameguro Viaduct in Japan, etc.[3]

Compared to foreign countries, the development of domestic viaducts is relatively late. The first viaduct in China was the Renmin Road Viaduct in Guangzhou, which was completed and put into use in 1987, when Renmin Road was a busy street. The use of the viaduct greatly alleviated the congestion, but also brought certain negative effects, such as blocking the appearance of the buildings on both sides, the commercial value of the street weakened. The space under the bridge is only used as a road divider with iron fence, not more use. Other cities in China, such as Shanghai, Shenzhen, Beijing and other major cities have a much richer type of use of the space under the viaducts. Shanghai Puxi viaduct is the world's only six-story structure of the overpass, the use of the space under the bridge is more diverse, both as a pedestrian passage, but also as a green park, greatly improving the utilization of space. The space under the viaducts in Beijing and Shenzhen, on the other hand, is used as a parking space or as a shared bike parking spot. The space under the elevated bridge as the city's gray space, how to effectively use the government departments and planning and design units face an important issue, the main use of the current form of greening, traffic, parking type, etc.. The main forms of under-bridge space are bridge shade space, ramp space and enclosed space. (As show in table 1)

Table 1: Classification of the form of utilization of the space under the viaduct of the road section and the corresponding list of applicable methods[4]

Type	Main content	Applicable methods
Greening type	Mostly road dividers under bridges, mainly green planting, often planted with shade-tolerant vegetation	Visual color, art and humanity, ecological measures
Transportation type	Bus stations, rail stations and other transportation facilities, such as Shanghai medium-capacity bus stations	Visual color, art and humanity, composite function
Parking type	Mainly parking lot and ancillary facilities	Visual color, art and humanities
Municipal type	Used for municipal management, such as bridge management rooms, electric power facilities rooms, etc.	Visual color
Storage type	As storage space for miscellaneous items, such as sanitation management facilities storage	Visual color
Commercial type	Set up commercial facilities or temporary commercial under the bridge, such as auto repair, food and beverage retail, etc.	Visual color, art and humanity, lighting and illumination, composite function
Leisure type	Combined with the surrounding set of public activity space under the bridge, such as under the bridge park, etc.	Visual color, art and humanity, ecological leisure, lighting and illumination, composite function

4. Morphological types of the space under the elevated bridge in Changchun

4.1 Municipal Green Belt

A large part of the space under the viaducts in Changchun is designed as municipal green belts. These green belts are mainly composed of low shrubs and some shade-loving plants, such as cattails and gooseberries. On the one hand, these green belts play an important role in purifying the air and beautifying the environment; on the other hand, they also separate the city roads in both directions, and

play a role in blocking the light of the opposite traffic at night, which reduces the traffic accidents to a certain extent.

4.2 Surface parking

Underneath the city viaducts are usually single-row columns or double-row columns, so they cannot be used as lanes for traffic. In the center of the city, if the form and spacing of the columns are suitable, and the conditions are developed as a parking lot, it is a good design choice. Across Changchun city expressway Xiangyue elevated, a large part of the space under the bridge is as a surface parking space. The space under the bridge to ensure the safety of parking in and out of the premise, the development of more urban parking spaces, can greatly alleviate the problem of parking tension in the area.

4.3 Urban support

Urban roads need to support a certain amount of control equipment rooms, set up these equipment rooms outside the red line of the road does not seem to be economical enough. And this time the space under the viaduct becomes a good choice - not only to reduce the length of cable lines, but also to save land.

5. Space for optimization and improvement of the space under the Changchun Viaduct

5.1 The space under the bridge may produce safety problems

The space under the elevated bridge is often used as municipal parking lot, and the entrance and exit of the parking lot converge into the node of the main road, if not left with enough buffer section, it is easy to produce safety hazards. In addition, some spaces under elevated bridges are developed as park green areas or shared bike parking points, and if the corresponding crossing bridges (or crosswalks) and other facilities are not set up, it is easy to make the intersection of pedestrian and vehicular traffic and create dangerous situations.

5.2 Advance design and integrated planning should be carried out

In recent years, the use of space under viaducts still belongs to a relatively crude, lack of unified planning model. Many of the space under the viaduct has not been designed in depth, but only as part of the road design or landscape design for simple space planning. Some of the space under the viaduct has even been changed several times, initially as a green belt, and then changed to other uses, resulting in a serious waste of social resources.

6. Design concept for the space under the elevated bridge in Changchun - a transformation solution for the traditional vegetable market space

6.1 Background of the location of the food market under the viaduct

Changchun city has many people and little land, and three-dimensional transportation plays a very important role. It is noteworthy that the land in Changchun is not fully utilized in the process of urban development, and the construction of elevated bridges occupies a large amount of urban space and cuts the original urban fabric. For a city like Changchun, where land resources are tight, it is of practical and positive significance to activate urban gray space, improve land utilization, and improve public facilities. Therefore, the full utilization of land has become a topic of great concern.

6.2 Feasibility of site selection

This paper suggests setting up a new vegetable market under the Changchun Xie Feng Interchange for the following reasons.

First, there are more residential areas around the site, which have a greater demand for agricultural and sideline products. Secondly, the site is close to the Shapowei business district, where there are many food and beverage stores, which also need a large amount of raw materials for ingredients; and the site can radiate a wide range, and the ingredients business within the radiation range is mainly small stores,

and the number of types is generally small, which is more in need of such a large comprehensive market, while the market as a livelihood project is also an important facility.

Secondly, from the perspective of traffic analysis, this place provides a relatively flush and wide space for the elevated lane, which also creates a greater possibility for the renovation project. The widening of the sidewalk and the numerous parking lots in the vicinity can also relieve the pressure on traffic when the formation of the market leads to a large amount of pedestrian and vehicular traffic.

Thirdly, as shown in Figure 1, the research on the application of the space under the bridge should be developed to diversify and create a colorful type of space that meets the regional characteristics and the needs of the people.

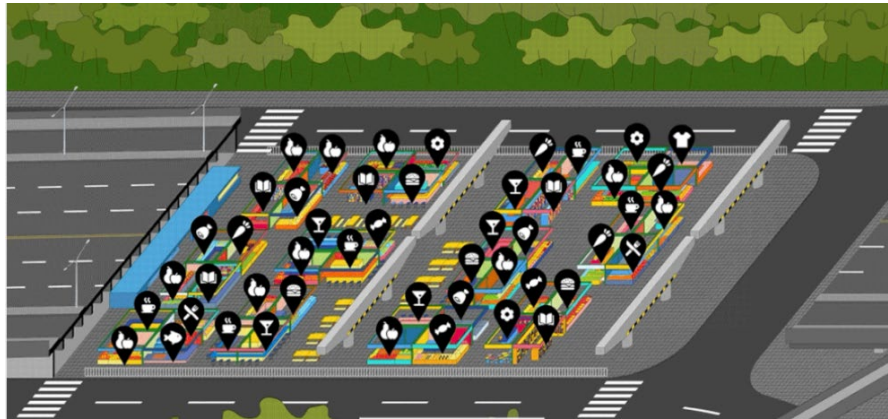


Figure 1: Site plan of the food market, source: OPEN Architects

6.3 Elements of the construction of the space of the vegetable market under the bridge

6.3.1 Diversified business mode

The commercial space under the bridge is mostly located in the central city where the crowd is dense and the land is tight. Individual stores under the bridge or continuous commercial streets under the bridge make efficient use of the scarce land resources and bring economic benefits.

6.3.2 Safety and comfort in the under-bridge space

The top of the store under the bridge usually relies on the bridge structure, which is a kind of "infill" building. As with traditional indoor spaces, under-bridge stores need to be built with seismic reinforcement systems and fire-fighting facilities in mind to ensure the safety of the indoor space. In terms of appearance, each store in the under-bridge shopping street pursues individuality while maintaining a unified whole. The space is extremely permeable, while reducing the oppressive dullness of the space, and the number of entrances is increased as much as possible to facilitate the entry of people from all directions.

6.3.3 The scale effect

The commercial street under the bridge has a rich composition of business forms, which is important for strengthening the regional connection and enriching the urban pedestrian space, and at the same time, it is compatible with the advantages of the surrounding natural landscape and has the tendency to develop into a commercial complex. The commercial corridor distributed along the parallel space can be extended to both sides, which brings scale effect and facilitates competition among stores and long-term operation, and also enriches the spatial experience of pedestrians on foot.

7. Conclusion

In this paper, we have studied the space under the elevated bridges in the city and analyzed similar local planning and design approaches at home and abroad, that is, in addition to roads, parking lots, greenery and other functions, the space under the bridges can be used more as public services and public open space in a comprehensive and complex way, so as to improve urban functions and land efficiency. Some scholars have proposed the three principles of ecology, public welfare priority, and spatial resource integration for this type of planning, and the article gives a detailed practice and reference for this type

of space through the design practice of under-bridge space in Changchun. The use of space under the bridge should be aimed at reducing the damage of the viaduct to the urban landscape and saving urban space, so as to beautify the urban space as well as improve the urban functions, create a diversified culture under the viaduct, and improve the vitality, competitiveness and image of the city.

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