An Outstanding Project of Underground Space Utilization in Urban Redevelopment of Beijing

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ABSTRACT

In resent years, both urban construction and urban redevelopment in Beijing have picked up speed and have made considerable headway. This paper attempts to introduce one of the new achievements—the redevelopment of Zhong Guancun West Zone. An outline of redevelopment planning is presented first, and after that, the paper focuses on the explanation of the underground space development in this project. Finally, the characteristic features of the Zhong Guancun West Zone redevelopment are discussed from four aspects.

1. INTRODUCTION

Beijing is one of the famous historical age-old cities in the world. It has a long history as a capital of more than eight hundred years. Today, Beijing is the capital of People’s Republic of China, the political and cultural center of the whole country. However, Beijing city is facing with the same urban problems, such as crowded urban space, traffic jam, environmental pollution etc., with which a lot of cities of developed countries had faced thirty or forty years ago. So, for urban further modernization, the urban renewal and reconstruction are urgently needed.

Underground space has been widespread looked upon as one of the few natural resources which till now have not been fully exploited by mankind. Especially in China, rational development and comprehensive utilization of urban underground space not only can alleviate diverse contradictions in urban development and meet demands of urban space expansion, but also open up vast vistas for urban modernization development.

Under these circumstances, underground space utilization in Beijing has made great progress and plays important role in urban redevelopment. In resent ten years, the three-dimension urban redevelopment in Beijing has met with a certain successes. Among them, the redevelopment of Zong Guancun West Zone, especially, its underground space development is now commonly considered as an outstanding and successful project. This paper just attempts to briefly introduce this work to our overseas friends and people of the same trade or occupation.

2. OUTLINE OF THE REDEVELOPMENT PLANNING

According to the Master Plan of Beijing City, in northwest part of Beijing a high-tech development district in very large scale is shaping up and partially is constructed (Fig.1). The core area of this district is named Zhong Guancun West Zone with a total land area of 51.4hm². The general orientation of the West Zone is a central high-tech business zone including such functions as information exchange, research and development, exhibition and selling market for new products, center of capital market, decision and management of the high-tech property etc.

The master plan of Zhong Guancun West Zone redevelopment was determined after a planning competition. The prominent feature of the selected planning is of the principle of three-dimension
redevelopment. Here, aboveground reconstruction and underground space has been developed simultaneously as fully as possible. On the ground level, there are twenty office and trade buildings dividing into three high-rise groups with total floor area of one million m² and a large public square and green area, which cover an area of one hundred thousand m². Below the surface, the three-story underground buildings and structures have a capacity of five hundred thousand m².

Fig. 1. Geographical position of Zhong Guancun West Zone.

As a result of three-dimension redevelopment, the planning presents some perfect indexes: the capacity rate is 2.6, the building density is lower than 30%, the green space ratio is more than 35%. Furthermore, owing to the most vehicles are going underground, the air quality on the ground improves to a great extent.

3. **UNDERGROUND SPACE DEVELOPMENT**

In Zhong Guancun West Zone, underground space has been developed in very high strength. The proper ratio between underground and aboveground building area reaches 1:2. Underground buildings and structures might be divided into three main parts: car parks, shopping centers, and a multi-purpose tunnel for infrastructure.

3.1 **Underground car parks**

Most parts of small-size vehicles will be parking in underground. There are nearly ten thousand parking spaces distributed in 18 two-story underground car parks. Each park has a capacity of 150-300 cars. By building fire protection code, about two hundred exits should be laid out on the ground for so large scale parking facilities. It was simply a difficult problem for planners.

Fig. 2. Plan of the multi-purpose tunnel.

A ring-like underground traffic corridor located on the first floor of the multi-purpose tunnel links up with all of the underground car parks, and then, this difficulty was overcome. The traffic corridor reduced the number of entrance and exit to only thirteen pairs around the main road.
1. The traffic corridor
2. Water
3. Gas
4. Power
5. Communication cables

Fig. 3. Cross-section of the multi-purpose tunnel.

3.2 Underground shopping centers

After redevelopment, the Zong Guancun West Zone was named Zhong Guancun Plaza. Under the Plaza, three large-scale shopping centers, which consume a area of two hundred thousand m². There are a pedestrian-only shopping street, a Carrefour Supermarket (32000m²), an underground fashion mall (Hong Kong s la-vita, 35000m²). There are also two thousand parking spaces serving the shopping centers.

One of the main criteria of these centers was to combine all features of an active lifestyle: recreation, entertainment, dining and shopping. They become one of the largest shopping malls in west part of Beijing, and provide satisfied service not only for staff members working here, but also for broad masses of local residents.

3.3 Multi-purpose tunnel for urban infrastructure

In the central part of Zhong Guancun Plaza, a multi-purpose tunnel was constructed (Fig.2). It is a three-story structure, which can accommodate most contents of infrastructure within the Plaza. On the first floor, a traffic corridor is laid out, its use has been introduced in above section 3.1. The main utility lines are distributed on the second floor including water supply pipes, gas pipes, electric power cables, communication cables. Their branch lines go down to the third level (Fig.3).

The multi-purpose tunnel gives service to all large buildings within the Plaza. It is very convenient for relieving traffic, maintenance and management of the utility lines. The sewage pipes are buried in earth owing to their big diameters. Besides, there is an underground sewage treatment plant below the ground.

4. CHARACTERISTIC FEATURES OF ZHONG GUANCUN WEST ZONE REDEVELOPMENT

The successful redevelopment of Zhong Guancun West Zone has won the acclaim of the people at home and abroad for its following four characteristic features.

(1) Both above and below surface, urban space is developed as a unity either in planning stage or in construction.

In China, the harmonious development of the surface, ground, and subsurface space has step by step gained a common understanding in urban reconstruction. But in fact, people are still used to make redevelopment planning only for aboveground space. So, in many cases the planners are frequently required to make an additional planning for underground space utilization. It is difficult to get an unified development of urban space. The Zhong Guancun West Zone is one of the few examples of three-dimension redevelopment starting from planning stage and carrying through to the whole process of construction.
(2) The high strength development of underground space provides great possibility to improve the environment quality of urban space. In Zhong Guancun West Zone, the development quantity of underground space is about equal to 50% of the whole building capacity on the ground. This proportion is seldom seen till now in China. In result, a large part of urban functions has been placed underground. Thus, a delightful environment of urban space has been created because of separating the stream of people from lots of vehicles and reducing the building density aboveground. It is just the expectant target of urban three-dimension redevelopment.

(3) The traffic function has been entered into the multi-purpose tunnel for the first time. Over a long period of time, in Chinese cities most of the utility lines are separately buried in earth below the roads. It is very inconvenient for maintenance and management, and the roads are frequently broken. Construction of the multi-purpose tunnel is a best way to overcome this problem, and it is realized in Zhong Guancun West Zone. Furthermore, it is the first time to combine the traffic function into the tunnel. It is a significant event for urban construction of China, and it is worth to popularize to other cities.

(4) The schedule of underground construction in this area has been finished already, so that it makes possibility to retrieve the funds for construction for two years before completion of the whole project. In Zhong Guancun West Zone, at the beginning of construction, the foundation pit was excavated all over the building site. Thus, the underground construction work was as easy as on the ground, and finished almost at the same time. The construction cost was thereby cut down to a certain extent. In result, two years before the high-rise buildings were constructed, a large underground supermarket has opened for business. The funds for construction have retrieved for two years earlier than aboveground buildings. This way of fund retrieving is also the first time for urban redevelopment of Chinese cities.

5. **CONCLUDING REMARKS**

Redevelopment of Zhong Guancun West Zone and construction of Zhong Guancun Plaza are now drawing to an end. This project shows the new achievements of urban redevelopment of Beijing and serves as a window of Beijing open to the outside world. Thirty years ago, a Swedish scholar said: “Place things below the ground, and put men on the top” [2]. It is gratified, that his imagination has realized here today. It is expected, that in the foreseeable future, there will be more urban functions going to the underground, such as garbage transportation and treatment, logistics system, water and energy storage etc. The three-dimension urban redevelopment and large-scale underground space utilization undoubtedly open up a vast of prospects for urban construction and urban modernization of China.

**REFERENCES**

