RELATION BETWEEN THE MRT BUILDING AND UNDERGROUND SPACE EXPLOITATION
—A Case in Guangzhou City

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ABSTRACT: On the basis of analyzing the history and characteristics of the underground space exploitation and the urban space development in Guangzhou, and making a thorough study on the underground space exploitation based on the subway building, this paper points out some main problems in the exploitation of underground space in Guangzhou, and emphasizes that Guangzhou must develop the underground space on a large scale with the aid of the subway building, and puts forward a proposal on the urban space coordinate development between on-ground and underground in Guangzhou City.

KEY WORDS: Metro Rail Transit (MRT); underground space; Guangzhou City


The human developmental history reveals that man has never neglected exploiting the underground space, from the primitive 'cave living' to the 'underground village' in Matmata of Tunis, from the subsided 'cave dwelling' in the northwest of China to the present 'underground city'. The underground space has been exploited widely and deeply.

The widespread utilization of the urban underground space took place after the beginning of industrial revolutions and urbanization. Due to series of problems on urban development resulted from the over concentration of population and industry, cities have to seek a wider space for further new development. The exploitation of the urban underground space provides man with a new living space, and meets the space requirement that cannot be realized on the ground.

In Guangzhou, the superiority of speed of the MRT (Metro Rail Transit) makes people feel the great glamour of the underground world. And therefore, how to exploit the underground space in Guangzhou has become a heated subject.

The urban underground exploitation roughly includes traffic space, commerce and recreation space, business space, logistics space, manufacture space and storehouse space, etc. In this paper, we regard the traffic space, commerce and recreation space as the main object of study.

1 PROCESS AND FUNCTIONAL CHARACTERISTICS OF UNDERGROUND SPACE EXPLOITATION IN GUANGZHOU

1.1 Background of Underground Space Exploitation

1.1.1 Requirement of the urban space development

Many experts hold that the space scale of a city is closely related to the developmental level of the communication. The best radius of a city equals a distance that man can reach within an hour(TREFIL, 2000). In the recent twenty years, the built-up area in Guangzhou has been enlarging rapidly. Before 1966, it was only 54km² (including four districts: Liwan, Yuexiu, Haizhu and Dongshan). It had increased to 136km² by 1987...
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(with three more districts: Fangcun, Tianhe and Huangpu Economic Development Zone). After the 1990s, the urban area has covered Baiyun District and the whole Huangpu District. And in 1995, the built-up area reached 259km². At the end of 2000, Panyu and Huadu two cities acceded to Guangzhou City, becoming two districts of Guangzhou. As a result, the built-up area has extended to 3718km² (Guangzhou Statistical Bureau, 1987–2000). The expanding city space requires an improved communication to shorten the traffic time.

Meanwhile, the space characteristic of zonal clusters makes a huge pressure of traffic in the center cluster, and causes a serious block on the town roads. Therefore, it is far from enough to strengthen the functional ties among groups of the city just by a few main lines. But, the densely exploitation of the town land in the center area makes it almost impossible to extend traffic land. So, other ways have to be found. Only by tapping the latent road capacity, improving the traffic structure and developing the underground public communication with large capacity and fast speed can it be possible to reduce the traffic block on the ground, and help to develop the external space in city.

1.1.2 Motive force of development of urban economy

It requires large funds as the motive force for developing the urban underground space. According to preliminary statistics, in 2000, Guangzhou's gross domestic product (GDP) per person was about 34.5×10³ yuan (RMB), being US$4175 by the national average exchange rate (Guangzhou Statistical Bureau, 2001). According to the experiences of developed countries, a subway times begins when the GDP per person amounts to US$1000 (WANG, 2000). So Guangzhou is economically qualified for developing underground space on a large scale. The way of raising funds with various channels including financial allocation, overseas loans and the combined development along the subway lines, which has succeeded in No.1 subway and No.2 subway building, has rendered rich experience and effective model for further MRT development.

1.1.3 Drive force of MRT development

Whether the urban underground space building will become a network or not depends on the MRT (WANG, 2000). It is clear that, the MRT is the most active factor in the underground space. The road building in Guangzhou in the future will give the first place to the exploitation of the underground space. It has planned to build 99 tunnels and 7 metro lines by 2010. And we can foresee that Guangzhou will come into a new development age of underground space exploitation.

In the urban underground space planning, MRT is not only functional, but also plays an important role in shaping the space. For example, No.2 subway, No.3 subway and No.4 subway have changed the line's run in order to adapt the new planning of the urban development, thereby guide the city to extend to the east and the south. Therefore, Guangzhou must timely and rationally plan the exploitation of underground space with the aid of developing subway, so as to create an underground network with the subway as a framework, commercial town as a joint, and city plaza as a region.

1.2 Process and Functional Characteristics of Urban Underground Space Exploitation

1.2.1 Process of underground space exploitation

The early utilization of underground space in Guangzhou was mainly in form of civil air defense works on a small scale. After 1978, with the development of transportation, traffic tunnels began to come into being. For example, Ouzhuang Bridge with four stories, the first subsided grade separation bridge in China was built in 1983; later, many grade separation bridges and tunnels were built one after another. Over 5 pedestrian tunnels had been built by the end of 1987. In addition, the underground piping began to be constructed. Besides water supply and drainage pipelines, the communication lines, gas pipelines and optical cables etc., were built too. The building of basements—a structural characteristic of high buildings forms a new upsurge in underground space developing. But the underground exploitation is not paid enough attention to. More than 100 overpasses and 15 overhead roads were built in the 1990s, and only 1 pedestrian tunnel and 2 traffic tunnels were built in the same time. The underground space did not put into large-scale exploitation until the MRT was opened to traffic. No.1 subway in Guangzhou was put into use on June 28, 1999. The No. 2 subway began to be built in 2000. And the really upsurge in underground space developing set in till then. Only in 2001, 9 pedestrian tunnels and 6 traffic tunnels were built, and the No. 3 and 4 subways were planned. Up to now, all these convert the developing model in underground space from spot and small-scale linear construction into axis construction.

1.2.2 Functional distribution of underground space exploitation

The early civil air defense works were built for dis-