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The study about the integrated planning theory of surface and underground urban space

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Abstract

As the development of the economic of China and the acceleration of urbanization, metropolises have run out of land resources. The increasingly serious urban space constraints compel us to rethink profoundly the traditional urban planning theory. The traditional urban planning theory pays attention to the two-dimensional space perspective of the ground and the aboveground to solve the problem on urban development, while, the modern urban space is a three-dimensional space system which is made up of above and below parts of the space. Therefore, how to arrange appropriate functions of urban space and form a favourable urban function system according to the surface and underground urban space, is the problem needed to be solved by current urban planning. Planning urban space from the perspective of the integration of surface and underground space will re-examine and re-evaluate the urban space growth boundary and the bearing capacity, so that it will bring the innovations to theory, method and technology of traditional urban planning.

Keywords: surface ground space; underground space; integration; planning

1. Introduction

Along with the extensive development of rapid urbanization, the dramatical increase of urban population, the contradictions between urban space and functions are increasingly sharpened. Many cities have a "City Syndrome", such as crowded urban space, traffic congestion, environmental pollution, ecological degradation, resource scarcity, etc.[1] Asking the high altitude for space, construct the tall

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buildings and urban elevated road; requiring the ground for space, develop the urban underground space. The two measures have become the indispensible means of raising the urban space, easing traffic pressure and improving the urban environment. The current acknowledge of most people about the urban space is still in the concept of two-dimensional plane. Their main concern is the development of urban space which stays above the surface, in the horizontal direction. People pay attention to the two-dimensional space perspective of the ground and the aboveground to solve the problem on urban development, while underground space acted only as a supplementary ground space, or the substitute scheme, works only when the on-the-ground can not solve the conflicts. The lack of the understanding of above and below city space's coordinate development, and the isolated treatment toward the planning and construction of above and below ground space, give rise to the wasting of space resources and the hardness of improving the land utilization. Therefore, the correct understanding of the characteristics of the city on or under the ground, the coordinated development of the city's above and below space, as well as to overcome the one-side thinking of "underground supplying the above", is the precondition of using the urban space resources comprehensively and efficiently, solving urban problems and realizing the urban sustainable development strategy[2].

2. The integrated planning of surface and underground urban space will reassess the urban space constraints

Judging from the whole world, the reason of the crisis of field for the city`s development is the high strength of the city construction. We can clearly see that full floor utilization, high cubage, and excess high-rise buildings bring out the low afforestation and environmental degradation. For example, in Los-Angeles, US, there is no ground for the further expand construction. Even the "elevated road" offers the impossibility, which still need the "footprint" on the ground, while there is actually no floor to use. Additional, "Space" has been pointed out as a real luxury in Port Vision 2020 in Rotterdam, Netherlands.

From current situation in our country, this problem is more serious in the 13 metropolises with the population of over 2 million[3]. On the basis of the 2030 Overall City Strategy of Shenzhen, the contradiction between the potential of development and the lack of effective resources supply (especially land resources), will be the main bottleneck to restrict the future development of Shenzhen. On the ground of the Overall City Plan of Shenzhen (2010~2020), the total area of the city is 1952.84 square kilometers, and 45.57% portion of the total, which is about 890 square kilometers, is using for the construct. Besides, the already-constructed-area occupies about 634.22 square kilometers. It is the fact that, Shenzhen is suffering in a crisis of lacking of land resources, since the 30 years' development of this city has used up nearly two-thirds of the land of construction[4].

Underground urban space is a kind of enormous and abundant space resources. It can be a good way to ease the shortage of the urban land resources if it has been used reasonably. According to the Underground Space Resource Plan of Shenzhen, the volume of superficial (0~-10m) underground space resource is 4.55 billion cubic meters. Theoretically, nearly 2.05 billion cubic meters is available for development. Calculated by the floor height of 5 meters, superficial underground space can provide 411 million square meters for construction. Additional, the sub-superficial (-10m~-30m) underground space resource is 14.95 billion cubic meters. Also, theoretically, nearly 4.55 cubic meters is available for development. Calculated by the floor height of 5 meters, sub-superficial underground space can provide 910 million square meters for construction. Therefore, there is totally 1.321 billion cubic meters superficial and sub-superficial underground space that can be used for construction[5].

The Tokyo Declaration passed on the international academic conference of underground space in Tokyo, in 1991, proposed "the 21st century is the century of underground space development and utilization", and predicted that "there will be a third portion of the world's population living in the