ISSN: 2472-3703 DOI: 10.6911/WSRJ.202010_6(10).0018

Research on Compact Development of Large General Hospital in Mountain Areas

Xiaoli He[1], Jinbi Ye[2,*]

[1]Yarui architectural design co., LTD. Xiamen branch, Xiamen, China.

[2]College of Civil Engineering and Architecture, Xiamen University of Technology, Xiamen, China.

[a]Corresponding author Email: Yejinbi@xmut.edu.cn

Abstract

Based on the analysis of the present situation and existing problems of the infrastructure of large hospitals in China, this paper puts forward compact development strategies for hospital construction in Mountain areas, including rational utilization of terrain, development of underground space, three-dimensional transportation and design strategies for building hospital complex. The compact development model can make full use of the topography and landform of hilly areas and provide a new way for the construction of hospitals in Hilly areas.

Keywords

Mountain; large general hospitals; compact development.

1. INTRODUCTION

With the continuous development of China's economy, the existing hospital buildings can't meet the development requirements of the new period to a certain extent, and it is urgent to build, rebuild and expand them, so as to realize the sustainable development of medical buildings.

Compared with cities with vast areas, the shortage of urban land is more prominent in the development process of cities with limited spatial form, such as hilly areas (Fujian Province and Zhejiang Province), island cities (such as Xiamen Island), mountain cities (such as Chongqing) and valley cities (such as Lanzhou). Cities with limited spatial form can't follow the old urbanization road of disorderly expansion all the time, so it is urgent to explore the urban development mode more in line with the concept of sustainable development and ecological city. Some scholars put forward the urban model of "compact development" [1-4]. The urban expansion cases of Hong Kong Island and Singapore Island have proved the feasibility of the compact city theory in the construction of the city with limited spatial form. This paper draws lessons from the compact city theory and applies it to the planning and construction of large hospitals to promote the sustainable development of hospitals.

2. MORPHOLOGICAL CHARACTERISTICS OF LARGE GENERAL HOSPITALS IN HILLY AREAS

Compared with plain cities, hospitals in mountainous and hilly areas are more difficult to build and expand. Fujian is taken as an example to explain below. Fujian is located in the southeast coast, which is known as "eight mountains, one water and one field", with few

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202010_6(10).0018

mountains and more land and poor land use conditions [5]. Available construction land is extremely short, especially in economically developed Xiamen and Quanzhou.

The dense population, lack of land resources, and high land costs in the urban center of the Xiamen area have resulted in the formation of a high-density and compact urban form in some areas in Xiamen's urban development. Xiamen Island is the urban center area of Xiamen City, with early urbanization, rapid development, high level, and dense population. The urbanization rate of Siming District reaches 68.18% [1]. Most of the large general hospitals in Xiamen are located in the central area of the city (such as Zhongshan Hospital affiliated to Fudan University, Xiamen First Hospital affiliated to Xiamen University, Xiamen Maternal and Child Health Hospital, Xiamen Eye Center Hospital affiliated to Xiamen University, Xiamen Chinese Medicine Hospital, 174 Hospital of PLA) or near suburbs with convenient transportation (Xiamen Chang Gung Hospital, Xiamen Second Hospital, Xiamen Haicang Branch and Xinglin Branch of First Hospital).

3. HOSPITAL DESIGN STRATEGY IN HILLY AREA

3.1. Rational Use of Terrain

Hospital construction in hilly areas is generally built on the mountain, which can not only reduce the construction cost, but also be convenient to use. The larger the slope, the more difficult and costly the project construction is, and the greater the possibility of geological disasters such as landslide or collapse. Therefore, construction on steep cliffs should be avoided as much as possible.

Grounding patterns of mountain buildings can be divided into three categories: underground, surface and overhead. Underground type means that the whole building is located below the ground, but the hospital is a public building. If it is all located underground, it will easily cause discomfort to the medical people. Surface type refers to the direct contact between buildings and slopes, which can adopt the forms of staggered floors, falling floors, falling or staggered stacking, and can also level the building site and treat it according to the flat buildings. Under the condition of no special requirements, should be preferred. The bottom of overhead building is made of pillars or local contact with the ground, which has the strongest adaptability to slope and little influence on mountain, and is beneficial to environmental protection, such as common diaojiao building. Generally, three grounding forms should be selected according to the terrain slope. In the case of large slope, overhead type can be adopted; Under the condition of small slope, surface type can be adopted; Fully underground is generally not applicable in hospital buildings.

3.2. Development and Utilization of Underground Space

Underground space development is the most effective way to expand urban space. Under hilly terrain conditions, the basement can use the slope to obtain certain natural lighting. This provides superior conditions for the development of underground space. Making full use of the underground and semi underground space in hilly area can greatly expand the urban space capacity.

The function of medical building is complex, the demand for medical technology room, equipment room and auxiliary room is large, and there are many patients and their families as well as medical staff. Parking difficulty has become a big problem faced by many hospitals. At present, many hospitals set equipment rooms and parking lots underground. However, in the development and utilization of hospital underground space in hilly areas, the following points should be paid attention to:

1) Make full use of the elevation difference in the master plan. In the planning and design, when the site has a certain slope, we can make full use of the terrain and design the

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202010_6(10).0018

underground space as a semi basement or earth covered building to ensure that the side of the basement can be directly ventilated and daylighting. This can not only effectively reduce building energy consumption, but also make patients and their families get a certain sense of pleasure, and eliminate people's prejudice against the dark, humid and airtight underground space.

2) Set up sunken patios, squares and passages. Sinking Square is widely used in large commercial squares, such as the famous Shanghai People's Square. When it is introduced into medical buildings, it can effectively disperse the flow of people and vehicles, create more interfaces between underground space and external environment, and create rich and dynamic architectural space.

3) The functional division of underground space should be treated differently. In the utilization of underground space in hospital buildings, underground space is usually used as parking lot, equipment room, auxiliary function room, supermarket, etc., but seldom used as ward and emergency room. In other words, the building space that people will not stay for a long time can be set underground, more ground space will be left for patients and doctors, more green land will be reserved, and a comfortable and healthy medical environment can be created.

3.3. Three Dimensional Transportation

The traffic in mountainous and hilly areas needs to solve not only horizontal transportation but also vertical traffic problems caused by height difference, that is to say, the traffic organization in hilly areas is three-dimensional. Although vertical transportation brings some difficulties to traffic organization, it is possible to separate various streamline lines of medical buildings on different horizontal planes by extending traffic organization from two-dimensional plane to three-dimensional space

1) Set entrances and exits at different heights according to the terrain

Setting entrances and exits at different heights according to terrain is a major feature of buildings in hilly areas. Usually, an entrance and exit can be set at the bottom of buildings or other lower positions, and then an entrance and exit can be set at a certain height. The entrance and exit can be set on the same vertical plane, and can also be set on the opposite side or side of the building depending on the terrain. Under normal circumstances, multiple entrances and exits can be set flexibly according to terrain and actual needs, which is more advantageous in hospital buildings. Patients can enter the hospital from different entrances and exits according to their own needs, which avoids internal travel and mutual interference to a certain extent, and greatly reduces the vertical traffic volume in the hospital building. So as to realize the separation of people and vehicles, clean and dirty and crowd, and ensure the cleanliness and order of hospitals.

2) Make full use of logistics means

With the development of science and technology, logistics means are becoming more and more developed, which makes it possible to reorganize the traffic in hospital buildings. It is possible to transport medical cleaning materials, medical filth and medicines through the logistics system in the building. The elevator will no longer be used as a transportation channel for medical supplies and wastes, but simply as a vertical transportation for patients and medical staff, and also avoid cross-infection of medical supplies and wastes with patients, family members and medical staff in the elevator. Logistics means can not only solve the horizontal traffic, but also carry out vertical transportation in different heights of medical buildings, which greatly liberates human resources.

4) Using terrain to realize comprehensive traffic connection

Large hospitals in hilly areas are different from plain cities in terms of traffic connection, which can make full use of the terrain and realize the comprehensive connection between

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202010_6(10).0018

hospitals and different forms of traffic around them. Large hospitals are usually located in the city center, and there are usually public transportation such as subway and bus around them. It is necessary to make full use of the terrain and strengthen the organic connection between medical buildings and public transportation. Generally, the underground floor can be connected with the subway, and the ground floor can be connected with the public transportation. Sometimes, it is necessary to set up an air corridor to separate people and vehicles. With the increase of car ownership, the hospital should also consider the increasing parking demand of people, pay attention to the connection between medical area and underground garage in planning and design, so as to facilitate patients and their families to seek medical treatment and visit.

3.4. Construction of Hospital Complex

Southern Fujian is dominated by low mountains and hills, and its urban construction is limited by topography. Although it is not a typical mountainous city like Chongqing, it should be included in the category of mountainous hills for design. In urban construction, we should not copy the experience of plain cities, but adopt compact development ideas according to topography and geomorphology, considering the reality of land shortage in hilly areas. South Fujian has developed economy and is extremely short of land resources, which determines that cities with limited spatial form urgently need to change the existing urban development model. The development of hospital buildings also needs to consider the situation of urban land use and adopt a development model different from that of plain cities.

The essence of a city is concentration, and the significance of a city complex lies in concentrating the functions of shopping malls, retail, office, hotels, restaurants, apartments, and entertainment in a small-scale building complex to realize complementary advantages. People can realize work, rest, entertainment and other activities in a comprehensive body, without having to go to different places to realize these comprehensive functions, which greatly reduces people's travel volume, not only relieves traffic, but also facilitates people's production and life. With the wide application of urban complex, its advanced design concept has great enlightenment for large-scale general hospital buildings in hilly terrain.

On the basis of learning from the experience of urban complexes and considering the particularity of medical buildings, the hospital complex integrates the functions of medical treatment, medical research, health industry, medicine, pension, leisure and entertainment, catering, etc., organically combines the medical functions of the hospital with the surrounding industries and businesses, and provides patients with a convenient and relaxed medical environment, thus attracting more patients to come here for medical treatment. The construction of hospital complex can also reduce the number of people in and out. People can achieve medical treatment, health management, pension, catering and so on in the complex, which is not only convenient for patients, but also can bring certain economic benefits to the hospital.

4. CONCLUSIONS

Based on the analysis of the present situation and existing problems of large-scale hospital infrastructure in China, this paper puts forward the compact development strategy of hospital construction in hilly areas, including rational use of terrain, development of underground space, three-dimensional traffic and design strategy of building hospital complex. The compact hospital development model can effectively utilize the topography of hilly areas, and provide a new idea for the construction of hospitals in hilly areas.

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202010_6(10).0018

REFERENCES

[1] Huang Shuo, Guo Qinghai, Tang Lina. Research on compact development of cities with restricted spatial form-Taking Xiamen Island as an example[J]. Acta Ecologica Sinica, 2014, 34(12): 3158-3167.

[2] Chhetri P, Han J H, Chandra S, Corcoran J. Mapping urban residential density patterns: Compact city model in Melbourne, Australia[J]. City, Culture and Society, 2013, 4(2): 77-85.

[3] Boussauw K, Neutens T, Witlox F. Relationship between spatialproximity and travel-to-work distance: the effect of the compactcity[J]. Regional Studies, 2012, 46(6): 687-706.

[4] Wu Yuming. Research on the architectural design of a large general hospital under compact and complex terrain conditions-Taking the reconstruction and expansion project of Chongqing Fuling Central Hospital as an example [D]. Chongqing: Chongqing University, 2012.

[5] Chen Fen, Chen Wenhui. Topographic analysis of Fujian Province based on GIS[J]. Journal of East China University of Technology (Natural Science Edition), 2009, 32(2): 185-188.