Traffic Infrastructure Services the City: Study on Designing Strategies of Urban Subway Station Space

Lu Tingying*

Student, Center of Architecture Research and Design, University of Chinese Academy of Sciences, China

Abstract
In recent years, the subway has become the most important public transport in many cities. As the hub of the subway operation, these stations are not only crucial parts of the whole system, but also important nodes in the city. This paper concentrates on four aspects of urban landscape, interior space, multiple function arrangement and cultural atmosphere of subway station design. Based on the field research and analysis on some of the most representative ones in cities of China, Japan and several European countries, it defines the subway stations into four different kinds according to the relationship between the stations and various urban elements. On the basis of existing practice experiences, it seeks to summarize several instructional strategies that are easy to promote, thus making contributes to the future design of urban subway station space.

Keywords: Subway Station; Urban Space; Design Strategy; Relationship

1. Introduction

The rapid development of modern city has led to a series of urban problems such as traffic congestion and green shortage. Under the panic and anxiety from the tight resources of ground space, people are promoted to bring the concept of "vertical city" into reality.

Nowadays, the underground railway has gradually become the most important public transport in many cities, and more and more cities have begun to develop the subway system. As the hub of the subway operation, subway stations are not only crucial parts of the whole system, but also vital space and transportation nodes in the city. Mostly, they occupy important and convenient locations, playing an important role in connecting urban space and the transportation space. However, many subway stations are separated or even contradicted with the urban space to some degrees, both in the functions and spaces. They eventually become isolated entrances and exits on the ground, developing little relationship with their...
surrounding commercials, streets, parks or other elements. Besides, subway station space lacks its unique atmosphere and vitality. Therefore, it is urgent to consider of efficient methods to design people-oriented and vibrant subway stations which are well interactive with the city and its citizens.

2. Current situation

Table 1: Subway stations by architectures (Source: drawn by author)

<table>
<thead>
<tr>
<th>No.</th>
<th>City</th>
<th>Station</th>
<th>Year</th>
<th>Designer</th>
<th>Main characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>London</td>
<td>Canary Wharf</td>
<td>1992</td>
<td>Foster + Partners</td>
<td>Natural Light; Modern Material.</td>
</tr>
<tr>
<td>3</td>
<td>Madrid</td>
<td>Atocha</td>
<td>1992</td>
<td>Rafael Moneo</td>
<td>Transformation project; Traditional form.</td>
</tr>
<tr>
<td>4</td>
<td>Kyoto</td>
<td>Kyoto Station transfer</td>
<td>1997</td>
<td>Hiroshi Hara</td>
<td>Composite function; Open to the city.</td>
</tr>
<tr>
<td>5</td>
<td>Lisbon</td>
<td>Baixa Chiado</td>
<td>1998</td>
<td>Alvero Siza</td>
<td>Warm &amp; Pure interior space.</td>
</tr>
<tr>
<td>6</td>
<td>Tokyo</td>
<td>Lidanabashi</td>
<td>2000</td>
<td>Makoto Sei Watanabe</td>
<td>Architecture as ‘seed’.</td>
</tr>
<tr>
<td>7</td>
<td>Porto</td>
<td>Casa da Musica</td>
<td>2002</td>
<td>Eduardo Souto de Moura</td>
<td>Two geometric skylights are the only</td>
</tr>
<tr>
<td>8</td>
<td>Porto</td>
<td>Trindade</td>
<td>2002</td>
<td>Eduardo Souto de Moura</td>
<td>Harmonious with the old church; Mosaic</td>
</tr>
<tr>
<td>9</td>
<td>Hague</td>
<td>Souterrain tram tunnel</td>
<td>2004</td>
<td>OMA</td>
<td>Concerned about urban space; “hamburger”</td>
</tr>
<tr>
<td>10</td>
<td>Berlin</td>
<td>Berlin Hauptbahnhof</td>
<td>2006</td>
<td>GMP</td>
<td>Void space; Independent routes, multifunction.</td>
</tr>
<tr>
<td>11</td>
<td>Tokyo</td>
<td>Shibuya Line extension</td>
<td>2008</td>
<td>Tadao Ando</td>
<td>Void space; Independent routes, multifunction.</td>
</tr>
<tr>
<td>12</td>
<td>Riyadh</td>
<td>KAFD Line extension</td>
<td>2013</td>
<td>Zaha Hadid</td>
<td>Integrity of interior and the form.</td>
</tr>
<tr>
<td>14</td>
<td>Paris</td>
<td>Clichy-Montfermeill</td>
<td>2015</td>
<td>EMBT &amp; Bordas + Peiro</td>
<td>Dinosaur shape; Steel.</td>
</tr>
<tr>
<td>15</td>
<td>Paris</td>
<td>Saint-Denis Pleyel</td>
<td>2015</td>
<td>Kengo Kuma</td>
<td>Transparent façade; Composite function.</td>
</tr>
</tbody>
</table>

In 1863, London opened first subway line in the world. Compared with the ground buildings, underground engineering design is fiercely limited by the structure and construction. Until the end of the 20th century, most of the underground rail transit construction are still led by the engineers. As the subordinate orbital lines of the subsidiary nodes, subway stations never attract the attention of architects. Therefore, many of the urban subway stations are of batch design, which are lack of recognition and have monotonous space. More than this, some could even undermine the city style or damage the links between blocks.

In 1927, Japan opened its first subway line in Tokyo, redefining the meaning of subway station which is the first transportation complex. Then in 1992, the design competition results of 11 subway stations of the London Jubilee extension line were announced. All these stations are designed by different architects, including the British architect Norman Foster. Since then, more and more architects all over the world have put forward their unique design of the subway station practices. In 1998, Portuguese architect Alvero Siza designed the Baixa Chiado Station in Lison, using rather simple structures and decorations to create a pure
but highly recognizable space. In 2008, Japanese architect Tadao Ando presided over the Shibuya subway station extension project and created a concrete ‘spaceship’ as an identification symbol.

In 2015, a number of internationally renowned firms participated in the Paris subway station design competition, including Danish BIG, Japanese architect Kengo Kuma and Spanish office EMBT. It is predicted that until 2030, Paris will have more than 70 subway stations designed by architects around the world.

3. Design strategy of subway station

For the subway station building design, the most important is the efficiency and safety. Except for the reasonable service radius of each site, the combination with the urban elements are also taken in account when choosing the station locations. In the theory of Kevin Lynch, the roads, borders, regions, nodes and markers are basic elements of a city, and each of them corresponds to different traffic conditions, flow of people and urban functions. In the modern city, the streets, intercity hub, urban landmarks and commercial stations set up a key part of the subway station. For the city, subway stations are fundamental infrastructures. As a kind of underground building, subway stations must be designed from all the function, form and space to ensure the integrity as the same as other types of architectures.

3.1 City Street Station: echo the city landscape

Street is the most fundamental element of a city, forming the basic urban network. Most of the subway lines are laid along the main streets, resulting in a large number of urban street stations. These sites are usually located at the road junction and are strongly independent. However, since the exits are close to the surrounding buildings, their external forms are more likely to have an impact on the city.

The completion of Hague Souterrain Tram Tunnel in 2004 was operated by OMA architects. It contains two metro stations and an underground tunnel at the pedestrian street below the city center. The architects highly publicize the attitude different from the pragmatists. They are able to control the whole when faced with challenges from cities, venues, functions, space, and structures. For the user, this tram tunnel has a unique affinity which is rooted in the surrounding environment and close to the city life.

There are subway stations on each end of the tunnel, that is, the Spui station and Grote Markt station. The Spui station is close to the Hague Municipal Center and located beneath the central commercial street. Commercial street has huge traffics, thus the station entrance needs to be easily identified. It can not stop the flow of people or block the sight. Koolhaas fully respect the overall atmosphere of the commercial street when designing Spui station, so that the entrance reflects the city's modernity, and provide leisure seats for visitors as well.

On the other hand, the Grote Markt station is between a market square and the Grote Markt street. In European cities, squares are important gathering place. According to Christopher Alexander in his book ‘A Pattern Language’, ‘Each subculture needs a center for its public life: a place where you can go to see people, and to be seen.’ Even a small market square can enhance the vitality of the city, and provide the surrounding community with the necessary facilities. Considering this, the architect conceals the entrance underground and creates a landscape.
3.2 intercity hub: the pursuit of efficiency

As a transit hub of intercity rail transit, intercity hub subway station must ensure maximum transfer efficiency. This type of station traffic is huge, not only need a clear streamline, clear instructions system, but also a reasonable functional partition, to provide passengers with the necessary service facilities.

The Berlin Central Railway Station was designed by GMP Architects and opened in 2006. This lasted 10 years, costing 13 billion euros built five layers of steel structure, covering an area of 15,000 square meters, has become Europe's largest railway station. Station ground track length of 320 meters, the ground floor of 450 meters long, with more than 80 stores.

The most impressive feature of this central station is to have a huge upper and lower transparent atrium. Shops, restaurants, apotheke and other basic service facilities are arranged around the courtyard. In addition to the necessary vertical traffic, the atrium part does not have any extra cut-off or rooms. As a result, passengers can see the highway trains above and underground railways below in any part of the atrium. Transparent vision also help passengers choose their vertical traffic, easy to transfer to their destinations.

3.3 landmark station: create a cultural atmosphere

Urban landmarks are usually a symbol of the spirit of the city, and has a direct psychological contact with the city. For foreign tourists, urban landmarks mostly make the first impression on most of them. As a result, the image and atmosphere of urban landmark stations are of vital importance to the spread of urban culture. Culture represents spiritual activity of a city. In addition to traditional culture, the modern city culture also includes the people's spiritual and cultural life.

Shanghai Jing'an Temple is one of the key national monasteries of Buddhism in Han nationality. Jing'an Temple Square is located in the southeast corner of Nanjing West Road and Huashan Road intersection, located against Jing'an Temple across the street. It covers an area of over 8,000 square meters. The
underground construction area is about 3,000 square meters, and is 7.20 meters below the ground. north and subway station connected to the south and underground shopping malls depend on, is a continental style square.

There is no hard border between Jing’an Temple Station and the underground square. The exit and the semi-circular view stands are visible to each other. Also, the trees behind have separated the distant high-rise buildings from the square. On the ladder stands, people could see the golden roof of Jing’an Temple, which partially represents the traditional culture. The convergence of the square and the subway entrance could ensure the safety of pedestrians, making it independent with the city roadway. On the other hand, the square is accessible for small events. It makes it possible to create a favorable area of public activity which enriches citizens’ lives.

![Fig.3. Section diagram and environment of Shanghai Jing’an Temple Station. (Source: drawn/shot by author)](image)

3.4 commercial station area: assume the composite function

Sometimes, subway station is not an architectural concept, but rather a broad concept of a station-centric area. Its form is weakened, while the centrality of its function is thus solidified and strengthened. Japan, because of its extreme shortcomings of geographical area, has become the first country to start comprehensive research and practice of the underground space. Through the strategy of joint development, there have developed a thoroughly accessed underground street in Tokyo and Osaka.

Shinjuku station is famous for its convenient transportation, complete function and the highest passenger volume. It has more than 200 entrances and exits, connecting the surrounding KEIO, ODAKYU, LUMINE and many other department stores and shops. In the Shinjuku bus transfer hub which was opened on April 4th, 2016, the high-speed bus, taxi and subway transfer formed a comprehensive traffic node. In the south, a comprehensive building was constructed, whose building area is 110,000 square meters. Its main functions include office, business, catering, conference, cultural facilities and so on.

In addition to the external height of the composite function, the station is also like a department store. Newspaper kiosks, clothing stores, lunch shops, small supermarkets, grocery stores, self-service drinks and other ancillary facilities readily available. Despite the limited innovation in the space form, the Shinjuku station still shows the greatest influence with its highly integrated function configuration, making it the largest traffic - commercial complex of Tokyo.
Fig.4. Section diagram and interior space of JR Shinjuku Station in Tokyo. (Source: drawn/shot by author)

4. Conclusion

The underground architecture has been existing since a very ancient time, but today it turns to be recognized as convenience, comfort, ecology, diversity and openness, rather than death, crime and dirty. Subway stations have become indispensable parts of city life, but only a few can be recognizable. By summarizing the practices of existed subway stations, we conclude that the participations of architects are increasing nowadays. Their concerns are far beyond the convenience of transportation, but more about the positive effect on the city which can be achieved by underground infrastructures. The design of street stations, intercity hubs, landmarks stations and commercial station areas naturally put concentrates on different aspects, because they are combined at quite different points. Therefore, a kind of multi-angle and all-round design from the aspects of landscape, efficiency, culture and function will lead the trend of subway station design.

References