Consideration on the Key Elements of Exterior Environment of Underground Public Architectures and their integrations

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ABSTRACT

People begin to think much of the integration and harmony between architectures and their environment and urban ecology, seeing that much of the urban landscape and natural environment is being destroyed. Underground public architectures have exceptional advantages for these problems. After analyzing the environment and the key elements of exterior and interior of underground space, this article abstracts key links and approaches the main modes of integration containing those key elements.

1. INTRODUCTION

With the sustainable fast development of Chinese economy, China has been on the state of speedy urbanization. With the shortage of the land, it is inevitable to make planning and use of underground space. These underground public architectures for transportation, commerce, culture, entertainment and etc are playing more and more important roles in the perfecting of urban functions and beautifying of the landscape of the city. At the same time, seeing that much of the urban landscape and natural environment is being destroyed. Underground public architectures have exceptional advantages for these problems, people begin to think much of the integration and harmony between architectures and their environment and the urban ecology (Zhang Jiantao & Liu Saojun, 2002). The advantages of underground space itself make it easy to solve these problems. In order to make the use of advantages of different underground architectures in different areas, the internal relations of underground public architectures should be understood correctly. And then the design process will be more clear and systematic if the inscapes from all of the exterior elements can be drawn and integrated.

2. CONCEPTIONS

2.1 Underground public architectures

Underground public architectures can be used for living, transportation, manufacture, and storage. Besides, we also can see many shops, culture and education buildings, entertainment facilities and gymnasiums underground. The history of underground public architecture is not long, but its role is very big (Tung Lin-hsu, 1994). With the city more intensive and the development of subways, underground public architecture together with the subway stations become complex facilities, and a key node of the whole city multi-function. Figure 1 is the underground public complex of Qianjiang New City in Hangzhou.

2.2 The environment of underground public architectures

A review of the history of the Chinese underground public architecture, we can see that more and
more attention is being paid from civil air facilities to the perfecting of city function and improvement of urban environment. As a result, underground public architectures are more commodious, more harmonic with other ground buildings and their outer space. The 3-dimesional space is more unified. The outside environment of underground public architecture is a virtual space with its surrounding buildings, ground land and the interface of it. The environment separates from buildings (underground part included) and becomes an individual, enclosed, different space. Comparing with ground buildings, the main character of the environment is not a substance made up of the profile and entity, but embodied by the integration of the whole space including ground and underground space. And some special elements of the image of underground public architecture are introduced into the outside environment space. Figure 2 is the outside of Mutual of Omaha addition in U.S.A. The key design of it is the glass roof of the atrium.

2.3 Inscapes of environment of underground public architecture

Whether the object is big or different, the environment of building always consists of some indispensable elements (Kenchiku Gaibu Kukan, 1988). We call it “inscapes”. These inscapes of environment of underground public architecture can be divided into “inner inscapes” and “outer inscapes” by their relationships with it.

- “Inner inscapes” are decided by the function and composition of the architecture which usually embodied by facilities and such things related to the outside of underground public architecture. The image of the composition and organization of underground public architecture, and the external facilities for the internal environment and evacuation are mainly included.
- “Outer inscapes” can be seen from perspectives of the whole city and the plat. From the view of the city, the inscapes include context of the city, the artificial and the natural environments. From the view of the plat, the inscapes includes outline of underground public architecture, its enclosing buildings and other related facilities.

3. STUDY ON INNER INSCAPES OF ENVIRONMENT OF UNDERGROUND PUBLIC ARCHITECTURE

Underground public architectures are special buildings whose environment has different characters by ground architectures which decided by the relationship between their ground, the deep of protrusion and the outer facilities.

3.1 Composition and organization of underground public architecture

The whole body and the shape of underground public architectures are nearly invisible so that we can not easy to know their structure and organization. Anyone underground always loses direction-sense. Thus, it is more important to emphasize the intelligibility of composition and organization of
underground public architectures between their outer and inner space. To the inner space, it is not only
need to design a flown line easy to keep, an open space on the way from underground to ground, but
also outline the accurate shape of the underground architectures with their environment. At the same
time, much attention should be paid to the reaction of underground architect’s image to its
environment. And its image also has active effect on its environment’s frame, shape and space
texture. As a whole, we can create an expressive and harmonious environment for underground
public architectures. Figure 3 is airscape of Les Halles in Paris. From this picture, we can easily
know its overall composition and organization from its outer image and their leading role in the
form of frame and shape of underground public architecture.

3.2 Outer establishments for improvement of inside condition

Main barriers in design of underground public architecture are not physiological or technical
problems, but psychological ones (Carmody & Sterling, 1993). The major reasons are the shortage of
natural daylight and lack communications with outside. Sinking square, atrium, open exit, skylight and
initiative lighting and so on are good ways to meet the require of natural daylight and outward view.
These methods have been indispensable elements in modern underground public architectures. In fact,
these elements have direct relations with the composition and organization of underground public
architecture. For example, sinking courtyard with enough natural daylight and atrium with glass roof
for daylight, have the significance node of flown line and gathering space for inside people. The other
rooms are circling with the courtyard and atrium. Their space sequences are clear to see no matter
inside or outside space. The core of Mutual of Omaha addition is the atrium and the glass semi-sphere
roof over atrium in the center of the square.

3.3 Outside facilities for architecture’s functions and prevention against inner disaster

There many necessary facilities such as air vent, pipelines, fire evacuation, but in many cases their
large numbers and messy layout always give people bad impression about underground public
architectures. In order to eliminate these bad effects, we can combine the ground buildings with the
outside facilities of underground public architectures to form a unified image. For instance, the air
vent can coexist with the exit. In the trivial place, we can beautify the image of underground public
architecture in the design of its composition and landscape. Furthermore, the methods of “hiding” and
“showing” and “seeing the whole from the detail” are also useful.

4. STUDY ON OUTER INSCAPES OF ENVIRONMENT OF UNDERGROUND PUBLIC
ARCHITECTURE

The outer inscapes can be seen from two perspectives, one is from the whole city and the other is from
the plat. The division is not to separate its different respects but to unite them into a whole entity.
Every element can’t live without each other.

4.1 The perspective of the city

Any city has its special environment from its beginning. So the construction of underground public
architectures should have a full consideration on the whole city’s environment. Underground public
architectures should have the same character of the city and be a part of the whole city, especially

Fig. 3. Airscape of Les Halles in Paris.
some large underground complex in the important point of the city. The underground complex has multi-functions, and the relation between the architecture and its environment will direct affect the harmony with the city’s function. From the point space, the underground public architecture and the urban space, the ground space and underground space should combine each other.

Figure 4 is Contrast of Xi’an Gulou Square before and now. The Bell-tower and Drum-tower are national important cultural relics, so the construction of Gulou square must consider those conditions and factors in the preservation of ancient city and rebuilding. We need to create a complete toward the future and with a long history, so the Bell-tower and Drum-tower should be the main part of the whole engineering. To build a square with an underground space is the best choice. After analysis of relationship between underground public architecture, the urban organization, urban artificial landscape, natural elements and city context, we got the plan showing in figure 4 to realize the harmonization between the underground public architecture and the city organization and to keep the continuity and rationality. At the same time, for the destruction of urban structure and functions resulting by the former environment, using a new outer environment to improve the whole city, and we will get a balance between the environment, function and right order of the city in the end.

Fig. 4. Contrast of Xi’an Gulou Square before and after

4.2 The perspective of plat

The inscapes from the perspective of plat can be divided into 3 parts by the character of the profile of underground public architecture. The first is “direct interface”, which includes two types, one the is “hard” (e.g. Greenland) and other is the “soft” one (e.g. water). The second is the partition to limit the outside space of the underground space, such as building’s exposed wall, enclosing wall, paling, fence, mountain and beach. The third is the other facilities and ornamental works.

More attention should be paid to the drawing of border line and the design of individual space on the point of plat to Xi’an Gulou Square. The direct interface includes both the hard and the soft. So we can have a Greenland square and a sinking square. The Greenland Square is the biggest space in the whole engineering, which indicates the ancient city’s structure like a quadrate net, in which each line is a lane for public. The sinking square is a sight one for gathering of people. As a half-open space, the north of the square are commercial buildings and sinking underground pedestrian street. Both of them are subordinate to the Bell-tower and Drum-tower. The virtual space formed by the Bell-tower, Drum-tower and the West Street has a leading place. Every facility shows an ancient meaning of “Morning bell and Evening Dull”, and the center of which is the “Tower Spring”. The Tower Spring is not only a part of landscape, but also the roof of atrium of underground shop for natural daylight. The ridge of the glass tower is made in stainless steel, and its shape is in accord with the roof of the Bell-tower, Drum-tower.

5. STUDY ON INTEGRATION OF INSCAPES

From above study, we can see that the contents of these inscapes are large and its types are various. There must be some rules to organize them together. What is that, and it is a problem to be solved.
According to our experiences and former theories, it can be concluded that a good shape of inside space and distinct image from ground buildings are significant to underground public architectures. So integration of different inscapes is necessary. The relationship between them needs changing and adjusting and the separation should be avoided. At last, it will be realized that combination of shape and character of underground public architecture, its ground environment and the inside space. On the whole, for the inscapes of environment of underground public architecture, we look it as a whole and aim to find a new order. So that, the link point of different inscapes can be find and the harmonization with former city will easy to get in practice.

5.1 Integration of space orders

As we know, the main bodies of underground public architectures are underground, so it is easy to be accord with its history, culture, and environmental order. The harmonization and rebuild have most effect on the shape of outside environment of underground public architecture. We respect its history, culture, and environment, but this does not mean we will be restricted. The integration of new and old order means that the design should consider the modern society and its economy and technology. The finished architecture should stand a new image of city nowadays and keep its ancient history and culture on. For this, Louvre Museum rebuilt engineering is a good example. The main body of the rebuilt engineering is underground, except the glass pyramid, which is the center of the outside environment. The pyramid is 1/3 tall of the Louvre Museum, which conform to the classical scale of architecture. The classic and pure design well solves the conflict between new and old order and let us feel a classical spirit in modern society (see Fig. 5).

5.2 Integration of spaces

In order to get a better relationship among underground space, its surrounding buildings and the urban public space, the inscapes of interface of underground public architecture have multi-layer character, which are responsible for the combination of vertical and horizontal directions. These sinking squares can be call an individual part in the whole environment and it can regulate the scale of space, create a center of the plat and let people easily know the directions. The sinking square can improve the natural daylight, ventilation and the condition of underground space. By the way, it also can be used as an exit. For the identifiability of underground public architecture, the character of its composition and function should be reflected in the design of transport line, organization of functions on the point of interface. At the same time, the character, limitation, and scale can be indicated at the sight of enclosing elements. Fig. 6 is the underground commerce complex and landscape in Plot J2&4 in ZhenDong new developed area of Zhenzhou. In the north, key architecture rises as a way of round and parabola. Together with the sinking square and its interfaces, a multilayer space comes into being. And because of areas separate by their functions and the design of flown line, the layout and structure can be seen clearly from the outside.

Fig.5. Exterior environment of the Louvre. Fig.6. Underground commerce complex and its outside.
5.3 Integration of functions

To underground space architecture, its functions will be thought much more of, so the communication between it and other buildings will be ignored. As a result, underground space architecture will be more closed, especially large business complex with underground parking place. It is invested that these complexes with multifunction, complete facilities and luxury ornament will reduce their pleasures outside, and give people a cold and disappearing impress. So in the process of design and shaping of environment, the union of underground public architecture and its environment should be taken care of and the relation between underground space and the ground space should be strengthened. And in the design of individual place and facility, each should have multifunction and used both for underground and ground space, so that the public can more recognize the underground architecture and its special environment. The key building in Fig. 6 is the sinking square. It is the main entrance of underground space and so is the Greenland Park. From the picture, we can see underground and ground space become a whole. The “Glass Tower” is the focus of the environment and the indispensable facility for natural daylight and ventilation (refer Fig.7). This method to combine the engineering technology with landscape design is an important way to integrate the inscapes of environment of underground architecture.

5.4 Integration of artificial works and the nature

The harmonization with nature is the prominence character of underground architecture. But the self-enclosing sets a barrier between underground architecture and the natural environment, as a result psychological and physiological problem arise. So an effective method should be taken to integrate underground architecture and its environment, artificial and natural environment in order to reduce the separation of the organic system. The objects not only include the artificial and natural elements in the environment, but also the natural inscapes in environment and artificial environment. The import of natural elements into underground public architecture has some technological problems and often gives a farfetched feeling. But if we strengthen the integration of underground public architecture and its outside environment, it is easier to realize by the design of sinking square, atrium, facilities for daylight and etc. Furthermore, the natural landscape of outside environment can be introduced in to artificial one, and the whole space is more united. Shown in Fig.6, as a main entrance of sinking square, the ground is hard in order to emphasize the artificial element in natural environment. But the other square and even the roof around the key building are planted as one part of the nature and bring those natural elements of outside into underground space for the integration of artificial and natural works organically.

6. CONCLUSION

From the study on the character and inscapes of underground public architecture, we can draw out the integrated principle and several modes. We also realize the relation between the inscapes and their own law to avoid the separation in the design. The final aim is create a visible and mutual relationship between the inside space of underground architecture and its environment by the different inscapes on
the condition of realization of its function. Then a clear and complete image can be see and the position, scale and border will be easily distinguished too.

REFERENCES


