STUDY ON THE GENERAL SIGN SYSTEM FOR THE DAILY SERVICE AND DISASTER-PREVENTION

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ABSTRACT :

Safety and disaster-prevention general sign system of subway is the important component of the subway structure to confirm subway's operation safe and convenient, which plays a very important role in the evacuation. In this paper, the concept of subway safe and disaster-prevention general sign system is defined. Through investigation of subway sign system of Tokyo, Seoul, Busan, Beijing and Nanjing, similarities and differences between domestic and abroad sign are studied. The main design factors of subway sign are summed up by comparison, making subway systematic, concise, geographical, functional and international.

KEYWORDS: Subway, Sign system, Emergency dispersion, Design elements

1. INTRODUCTION

Sign is a tool used to convert information by visual figures, it is formed in the long term living and practice of human society, and plays an important role in identifying different event, for example, provide public some information such as direction, identification, warning, even command. Compared to language, sign is more visual and having more information. It can transfer information more exact and intense. Meanwhile, sign reflects the culture of a country or a city.

As one of the important component of transport hub, subway is requested to transport passenger quickly and reducing more ineffective linger time of passengers. Therefore, sign system plays an important role in exerting functions of railway transportation. Subway sign normally can be divided into disaster-prevention sign and general sign. Disaster-prevention sign is used in the disaster time to reduce the disaster losses. Sometimes, there is no premonition of disaster, in order to prevent the potential disasters, we must prevent disasters positive. According to past experiences, through summing up subway environment state, passenger psychology and behavior in disaster time, design scientific sign system, effectively alleviate the psychological pressure of passengers, reasonably guide the passengers and strive more valuable time for passenger escape and fire evacuation. General sign has two meanings: First, the sign to be designed must suit to passengers of different cultural level, different age and different nationalities. As the economic globalization, urbanization development, flow of the crowd, such as tourism, academic communication and trade cooperation is promoted, forcing subway sign meet the needs of various groups. Second, sign should be in service in safety time, while also in service in disaster time. Because of limited space subway, the amount of subway sign should be reduced as much as possible under the condition of not affect the sign function.

Study on urban environment sign has been began since a long time ago. Joseph Masala, in urban element--facilities and micro-architecture, defined urban information system firstly. U.S. Federal Ministry of Transportation, in national public sign design principles and graphics collected edition, defined public sign design principles in U.S., summed up the graphics in every location, and made them systematization.

Subway sign system has been studied by domestic relative scholar. Q.J. Wang, carried out further research and study on subway public environment transportation identify system. L.M. Zhu compared to subway environment in Paris, found that there are some problems in subway line sign design in Beijing. X. Wang compared the setting, the system, and the color of the system in Japan, Taiwan，Hong Kong and Shanghai mass transit. L. Wang, took analysis and study from space induction system, reformed and proposed the design principles in underground space.

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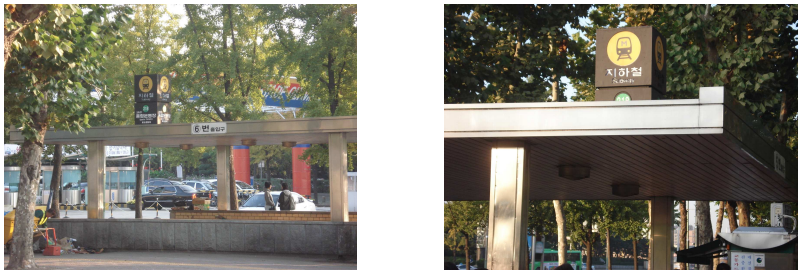
2. INVESTIGATION ON SIGN SYSTEM IN DOMESTIC CITY AND ABROAD

In order to investigate the present status of disaster-prevention and safety sign in domestic city and abroad, subway signs and relative equipments in Tokyo, Seoul, Busan, Beijing and Nanjing was investigated.

2.1. Subway Station Identification Sign

According to the survey, Seoul, Korea outside distinct of the station identification sign is the form of a rectangular, and four sides sign is same, the passengers can receive information in all directions of station, moreover, all of those are provided with Seoul subway standard sign, Chinese and English explain, and the bottom figures also indicate that the stations lines, as shown in Fig. 1.



a) Long-distance view **b)Short-distance view**

Fig. 1 Outside distinct of the station identification signs in Seoul subway station

Outside distinct of the station identification signs in domestic subway station use in the form shown in Fig. 2, the sign towards only one side, the visual range is from -90 ° to 90 °, it is not serviced in all directions around the area, additional stations Identification sign should be set in the opposite direction. Some signs only inform the subway stations, station name and corresponding operating lines were not provided, as shown in Fig. 3. In this regard, sign design of Fig. 3 is more reasonable.

Fig. 2 Outside distinct of the station identification signs in Beijing subway station

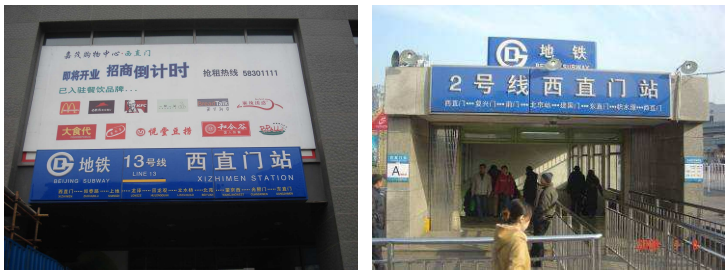


Fig. 3 Outside distinct of the station identification signs in Xizhimen subway station

Subway station identification signs are equivalent to the identity cards of the station, every station identification signs should be unified in form, but the content should be able to distinguish between each other. Station identification signs throughout the whole subway station, and the most important region is the outside distinct of stations and station platform. Outside distinct of station identification signs service the crowd of 750 meters around the station. Therefore, outside distinct of stations identification sign should be in large size, moreover, consideration should be taken to care of the crowd in all directions. The station identification sign of platform function is making passenger identify station better, avoid going into wrong station and getting off in wrong time.

2.2. Fire Sign

In present, there are two sets of automatic fire safety facilities in Beijing subway station: a set of two automatic monitoring systems, one is in the station, another is in a central control room, to monitor the subway stations situation; another set is automatic fire sprinkler system. It is provided with water jet and gas spray, suiting to different causes of fire control. There are specialized exhaust devices in subway tunnel, in case of fire, air

accident in the tunnel system will start and exhaust the toxic smoke outside in the shortest possible time, thus preventing passengers in suffocation. Subway trains are equipped with clear instructions of the emergency button, fire extinguishers and other safety facilities shown in Fig. 4

Fig. 4 Emergency button in Beijing subway train

Fig. 5 Fire extinguishers in Beijing subway train

Fig. 6 Fire extinguishers in Busan subway train

Subway disaster-prevention not only should do fully in equipment and sign, but also place the sign and related equipment to the correct location, and coordinate with each other. As shown in Fig. 5, Beijing subway fire extinguishers placed in the car under the seat. Under crowded conditions, it is difficult to get it into application timely. Moreover, the corresponding sign of fire this extinguisher placed in higher positions window, existing a certain gap in coordination. In addition, fire sign in Beijing subway is different in different regions, it affect passengers' understanding to sign in certain extent. Therefore, the unity of fire sign is needed to improve.
Seoul Subway sign are replaced by the burn-resisting, less smoke and halogen free materials, to prevent similar incidents from happening again. Moreover, sign design and planning were been improved. As shown in Fig. 6, fire-fighting equipment placed next to the location, and sign design in the appropriate position. In addition, relative subway department in Seoul had increased the inputs in the aspect of emergency rescue equipments, such as emergency masks, emergency stretcher, reserved power flashlights. In order to make passengers in disaster use relative equipment by themselves in disaster time, use method and attention issues should be marked on the equipment repository.

2.3. Emergency Exit Sign

When the large-scale emergency incident happens, exit is the destination of passengers evacuated to escape. Since the passenger is sudden increased, and the normal exits can not meet the evacuation requirement. So the emergency exits should be set. Meanwhile, because passengers are not familiar with emergency exits, emergency exits signs should be set to guide the passengers.
There is no relative sign system to refuge exit and refuge space. Moreover, because of some unfavorable factors, such as unreasonable signs, unobvious inducing lights and etc., make the emergency evacuation and refuge of large number of passenger impossible. Relative system setting is made in some foreign city subways. Fig. 7 is a refuge exit in Japan subway station, inducing lights and emergency lights equipments were setting in refuge exit, refuge exit is connected to passenger channel. There is no emergency refuge exit in relative place in some domestic subway stations (Fig. 8).

Fig. 7 Emergent refuge-exit of the subway station in Japan subway station

Fig. 8 No emergent refuge-exit in the Beijing subway station

2.4. Evacuation Sign

Evacuation sign plays an important role in the subway. Emergency evacuation time can be shorten and most scientific emergency evacuation line can be provided by reasonable effective sign, then the subway emergency rescue work can be proceed smoothly, passengers safe, scheduling command system and emergency rescue system can be confirmed.

Subway space is closed, directional and humdrum; it is difficult to position oneself in subway station. Using with evacuation sign, it will not only effectively help passengers retrieve the current location of the subway space and comprehensive information on the ground, but also give passengers a relatively accurate and stable psychological safe space. It is useful to escape in time and smooth development of emergency evacuation work..

In addition, taking the complexity structure of subway space into consideration, in order to help passengers not familiar with subway space travel, get off and transfer train, same style in subway station should be unified to avoid mutual confusion. In present, there are some problems of exit signs not only in forms but also positions. Fig. 9 shows the exit signs in Nanjing and Beijing subway station.

Fig. 9 Exit signs in Nanjing and Beijing subway station.

2.5. Other Ancillary Equipments

Since the space of subway is dark, the artificial lighting is used as the main light source in the subway. However the artificial lighting is insecure, especially when the disaster occurs, the light can be inadequate because of the broken circuit system, as a result, and the visual signs can not play a normal role. So apart from the visual signs, the other sensory-type signs should also be set up in the subway. For example, the sign shown in Fig.10 is just a general evacuation sign when the light is enough. While the light is poor, the both sides of it can shine and then it can be used as an inducement sign, it also can issue the warning voices. Emergency flashlights are shown in Fig. 11, which can supply a help to passengers when the power is off or the light is dim.

In addition, the Busan subway station has the detail descriptions of the use of related equipments so as the passengers can be familiar with them during their waiting (Fig.12). In view of this, the Beijing subway station can publicize the escape methods when the disaster occurs, and the expression must be simple.

Fig. 10 Multiplicate functions evacuation sign

Fig.11 Emergency flashlights

Fig. 12 Detail descriptions of the use of related equipments sign

3. AFFECT ELEMENTS OF SUBWAY SIGN SYSTEM DESIGN

Through the investigation of subway sign system of Tokyo, Seoul, Busan, Beijing and Nanjing we can find that affect elements of subway sign system design including color, content, scale, light, form, materials, etc.

3.1. Color

Safe color standard regulate four safe colors and two background colors in safe sign. Four safe colors include red, yellow, blue and green. Two background colors include black and white. Meanwhile, except from safe signs, there are some no-function signs in subway stations, such as line sign etc. Therefore, the colors used in subway sign system are more than regulated in safe color standard. Fig. 13 shows four safe colors signs.

Fig. 13 Four safe colors signs

3.2. Content

In the current subway sign system, most countries have adopted bold Chinese characters, because it is similar to the Latin alphabet of a decorative line. In subway sign design, text can be designed as a form of independent existence, can also be integrated with graphic design. Make design according to the design concept and the environment morphological characteristics, from the font, the word meaning, and other aspects considered.

Text design is first necessary to consider the text for the identification and readable. In order to effectively convey the meaning of sign in a short period, fonts should have a good identification, readable and give a clear visual impression that people easily identify, understand and avoid complicated, cluttered.

According to China's transport sector research, "Font of characters and the old song characters in static or close the state's better-performing reading speed." In addition to the character of its own research, selection and transformation, the font of black-and-white visual experience is not the same. Under normal circumstances, the white font and deep back is effective stronger than deep font and white back. Moreover, the transfer speed is faster. When using the lighting, the reflective or translucent of high brightness and bright colors is strong.

3.3. Scale

As shown in Fig.14, set two different sizes of the identified persons with disabilities at the same location, including larger sign for long distance passengers, and small sign was used for close-up crowd.

Fig. 14 Handicapped sign different size

Subway sign design must meet the standard of ergonomic requirements. Through statistical data, getting various activities scale, then apply the scale in the sign design, to ensure that activities designed to meet the demand. Whole conformation, micro material and texture must be combined, to create good and comfortable scale. Subway sign design should also consider the environment scale, to scale in an orderly manner.

3.4. Material

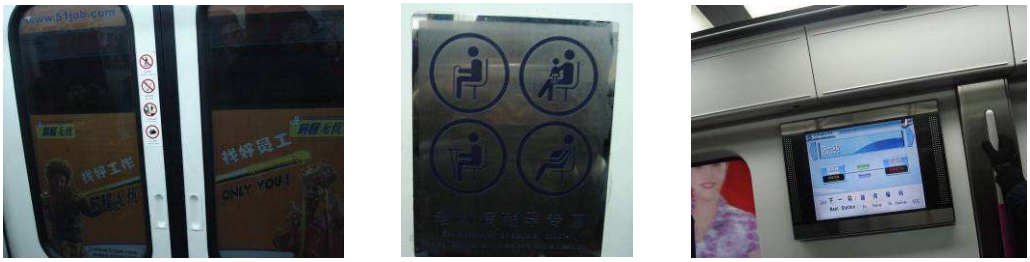


Fig. 15 Subway sign made of different material

In subway sign design, sign materials should be choose based on objective, structure of sign. Some materials have visual effects, but not coincide with the design philosophy or the structure not easy to achieve.
Material of subway sign should have a good fire resistance. Subway space is complex and relative closet. In case of fire, the sign of a good fire-resistant material can effectively delay the spread of fire, provide for the evacuation and rescue time. In addition, the subway sign also requires smoke-free or distributed by non-toxic smoke under high temperature.
Subway sign design should also be considered material life. Sign is exposed at a relatively open environment of the public, is largely destroyed by man-made and natural, material life must be considered in design.
Economic factors is another principle of material choice, including cost of sign, hard degree of construction, life of sign and maintenance charges of sign. Economic factors have an important impact on material choice. Generally, lower cost material should be chose, which can meet the functional and structural design requirements at the same time. Fig. 15 shows subway signs with different material.

3.5. Lighting Form

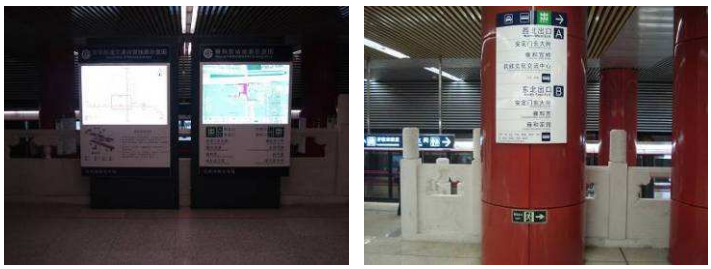


Fig. 16 Artificial lighting sign

Fig. 17 Natural lighting sign

Artificial lighting is the main form of lighting (Fig. 16). Normally, there is greater creativity in color, light and form. Natural lighting is natural, cordial, but subject to greater restrictions. Artificial lighting is the main lighting form of subway sign. In some outdoor occasions, such as the guide sign near the entrances and exits, can be used natural lighting form (Fig. 17). Taking night application of sign into account, some form of artificial lighting should be properly attached, to reduce the lack of light difficulties. Artificial lighting refers to the use of LED tools, achieving the desired lighting effects according to the needs of regulation, organization. The main incandescent lamps of artificial lighting are fluorescent lamps, mercury lamps and so on.
The lighting design of subway sign should pay attention to avoid glare. There are many reasons for the glare, such as the direct light source, mirrors or glass reflection of the light source, the surface of the diffuse, sign exposure too high brightness and contrast between the brightness. In the subway sign system, generally, to avoid the glare that the first to restrict the direct glare and avoid light exposure. Second, restrict reflective glare and adjust the location and source of the radiation point of view, in addition to change the effective of materials and texture, to reduce surface strength.

4. CONCLUSIONS

Recently, subway traffic accident is increased day by day, brings a lot of pressure to subway operation. In order to deal with potential disaster, a series of norms and plans has been promulgated by relative department, such as “subway design codes”, “national sudden public events overall emergency plans”, and “national disposal urban subway accident disaster emergency plans”, etc.

Subway sign system should be improve in several following aspects:

(1) On international aspect, international standard image should be adopted as possible as we can. In word explanation aspect, Chinese-English explanation sign should be adopted, meanwhile, Arabic numerals should be adopted as possible as we can.

(2) On systematic aspect, various type sign percentage in whole sign system should be determined according to the sign importance. Some signs should be set continuously and should be maintained a certain scale in height and spacing.

(3) On concise aspect, image should be adopted as possible as we can to express the meaning in sign design content. When international standard image can not be referenced, image should be designed as concise as possible under the condition of express meaning carefully.

(4) On geographical aspect, geographical features should be highlighted by subway sign design. Sometimes we can design the subway internal environment to highlight the geographical features.

(5) On functional aspect, sign function should be highlighted in sign design. In order to meet this requirement, sign meaning must be express carefully and quickly.

Through the investigation to subway domestic and abroad, it could be conclude that there are some problems in subway sign design in the country. For improving the sign function and effect, we must design on the base of psychological and physiological, considering the servable factor, such as curler, content, position, lighting way and so on .The paper presents the effect of the main factor to subway sign design. It plays a guidance role in the subway sign design.

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