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Underground railway safety analysis and planning strategy: a case of Harbin metro line 1, China

Guo Rong^a, Wang Sainan^a, Huang Mengshi^{a,*}

^a*Architecture, Harbin Institute of Technology, China*

Abstract

With the development of rapid urbanization, the urban expansion and traffic jams are the serious problem of city development. Underground railway plays an important role in urban public transport, which helps to ease traffic congestion. Because of the frequent accidents of underground railway, the research of underground railway safety and the planning strategies lays the foundation for the urban public safety research. This paper reveals the safety situation of Harbin Metro Line 1 in China from the passenger safety consciousness, equipment and environment, and management factors, through a series of subjective questionnaire surveys. However, the reliability and validity of the questionnaire survey are calculated by SPSS 22 software, and used to assess the qualities of investigation results. With the results, the safety problems and the pertinence planning strategies are put forward for Harbin Metro Line 1. The research has a reference value for underground railway planning and construction, and plays a foundation for improving urban public safety.

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Keywords: Underground railway safety, Planning Strategy, Questionnaire surveys, Harbin Metro Line 1, China.

1. Introduction

With the rapid development of urbanization, the problems of urban sprawl and worse ecological environment are serious. The development of underground space is one of the key means to solve the problem of urban capacity

* Corresponding author. Tel.: +86-130-590-276-63
E-mail address: 245770551@qq.com

expansion, and the effective mode to enhance urban functions, improve the urban environment, and save intensive land use. Urban public traffic safety is an important content of ensuring the city security. And the underground railway that it is efficient fast and alleviate traffic, as one part of urban public traffic, leads to frequency public safety accident because of the characteristic of sealing ability and liquidity. Since 2009, there are more than 100 underground railway safety accidents domestic and overseas, including fire, shutdown, crowded stampede, terrorist attacks[1]. The underground railway hidden danger, safety management and passenger safety awareness gradually caught attentions.

According to the related literature, the research of urban railway safety focused on the safety accident analysis, the safety influencing factors analysis, the safety risk assessment, and the safety management and warning. The subway systems are vulnerable to any number of nature and man-made hazards. Besides these vulnerabilities, subways may also be associated with a range of health and safety hazards that could affect both passengers and transit workers, included physical, biological, chemical, electro-magnetic radiation, psychosocial, and the threat of terrorism[2-4]. The safety influencing factors refer to natural, social, and political, economic, cultural and so on [5-7], and the equipment operation and management is the important factor [8, 9]. There are lots of research on safety risk assessment with the methods of qualitative and quantitative analysis, such as questionnaire method[10, 11], Fault Tree Analysis[1, 4], Fuzzy Mathematics method[12-14], Gray Correlation method[15, 16], AHP[17], and Neural network model. Among these methods, questionnaire method combined with other methods is the main study method for the safety risk assessment. To perfect the underground safety management and warning system is the important measures of urban public security improvements that is the common goal of related research. The researches show that the main strategies are including strengthen the awareness of public safety, improving the hardware and facilities construction, enhancing the underground railway safety maintenance [18, 19].

This paper aims to examine the underground railway safety of Harbin metro line 1 in China based on a series of field experiments and questionnaire surveys, including the passenger safety consciousness, equipment and environment, and management factors. And the current problems of underground railway safety of Harbin are analysed, and the strategies are put forward for underground railway construction and management to improving safety.

2. Methodology

2.1. The area and objective

The subjective survey mainly focused on the public and the underground railway staff. Questionnaires were distributed to 18 stations of Harbin metro line 1, as shown in Fig. 1. The passengers were randomly selected, and it was ensured that there were more than 20 valid questionnaires from each stations, and that the survey sample is representative.

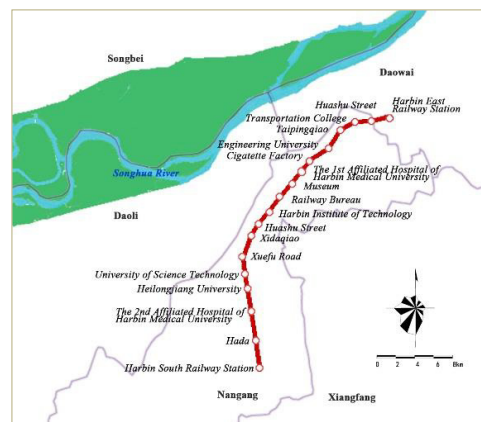


Fig. 1. The surveyed area (Harbin metro line 1).

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