The Research on Safety Management Information System of Railway Passenger Based on Risk Management Theory

Wenmin Zhu, Yuanhua Jia
School of Traffic and Transportation, Beijing Jiaotong University, Beijing 100000, China

*Corresponding author e-mail: 15120938@bjtu.edu.cn

Abstract. Based on the risk management theory and the PDCA cycle model, requirements of the railway passenger transport safety production is analyzed, and the establishment of the security risk assessment team is proposed to manage risk by FTA with Delphi from both qualitative and quantitative aspects. The safety production committee is also established to accomplish performance appraisal, which is for further ensuring the correctness of risk management results, optimizing the safety management business processes and improving risk management capabilities. The basic framework and risk information database of risk management information system of railway passenger transport safety are designed by Ajax, Web Services and SQL technologies. The system realizes functions about risk management, performance appraisal and data management, and provides an efficient and convenient information management platform for railway passenger safety manager.

1. Introduction

At present, railway information system covering the railway transportation enterprises, railway stations and depots is built up. Train Dispatching and Command Information System (TDCS), Railway Transportation Management Information System (TMIS), Railway Ticketing and Reserving System (TRS) are staples of it. We have made great achievements on the way to information construction of railway. In recent years, the CHINA RAILWAY is also promoting risk management theory in the whole railway, attaching much importance to management standardization and operation standardization, and deepening security risk management to enhance the level of railway safety management continuously. However, the business process for passenger safety risk management is not unified, and studies related to information system construction are not many.

Li Ke analyzed and designed the ATC safety risk management information system, which provides a systematic and efficient management tool for risk management and risk warning of air traffic controllers [1]. Lu Chao based on the risk assessment process, the building fire risk assessment management information system is established, which can accurately and quickly reflect the fire hazard information of the building and improve the fire safety level of the construction project [2]. Zhang Wanpeng in the risk management method and information processing platform in railway stations, Railway Construction Corporation and three level audit risk grading scheme and risk assessment process, provide support for railway safety risk management [3]. Liu Aihua believes that the system can be divided into two subsystems: command center subsystem and safety production management subsystem,
which can improve the efficiency of production organization and the timeliness of safety management [4].

It can be seen that the main functions of risk management information system in different industries are similar, and the four main functions is: risk identification, risk analysis, risk assessment and risk management. In the field of railway [5], the business process and scope of risk management has not yet been fully unified, so the requirements of management standardization and operation standardization are not met. There is a great research space on the risk management system for railway passenger transport.

This paper is based on the theory of risk and system development tools such as Microsoft.NET, Ajax, and Web Services and SQL database. It put forward the risk management process of railway passenger transport safety, designed risk management information system of railway passenger transport safety, and provided an integrated, efficient and convenient management platform for management of passenger transport safety.

2. Demand Analysis of Passenger Safety Management Information System

As a Safety Management Information System, functions about risk identification, analysis and control should be satisfied. At the same time, the system should employ the PDCA cycle management model, which is often employed to Enterprise Quality Management for optimal results.

2.1. Function analysis

All the main work of railway passenger transport is to transfer passengers and their luggage from one place to another by train safely. Railway passenger stations and sections are directly responsible for the organization of passenger transport, and the efficiency of security work affects the safety of railway passenger transportation directly. In the process of passenger service, there are a large number of unstable factors that affect safety such as personnel, equipment, environment and management. According to the theory of risk management, the information system of railway passenger transport safety needs to complete two major businesses: the first is to carry out the safety risk management of passenger transport, and the second is to provide a convenient and comprehensive assessment method for managerial personnel.

2.2. Business process

![Figure 1. Passenger Safety Management Business Process.](image-url)
In order to improve the efficiency of passenger traffic safety management, setting up a safety risk assessment team, safety production committee to complete the work of the passenger safety risk management and performance appraisal with staff of team, workshop and department. The specific business processes are shown in figure 1.

This business process involves the cooperation of three departments which are the supervision staff, the risk assessment team and the safety production committee, it realizes the function of risk analysis, control, reanalysis, re-controlling and quality assessment, these functions further guaranteed the accuracy of the risk analysis results and the rationality of the disposal methods.

3. Design of the Safety Service Information System

Through the analysis of passenger safety risk management business processes and functional requirements, in order to complete the goal of safety risk management, the four kinds of users are designed: safety inspection personnel, risk assessment team members, safety committee and other leading cadres. As well as the five business subsystems: safety supervision, risk assessment, risk control, inspection and acceptance, report management, the user and privilege level of each subsystem is specific. The frame of railway passenger traffic safety service information system is shown in figure 2.

![Diagram](image)

**Figure 2.** Frame of Railway Passenger Traffic Safety Service Information System

The personnel and activities of railway passenger traffic safety risk management are numerous. For the users who login the system, different limits of authority are given by different user identities. Workers of workshop and team are responsible for daily passenger production operation, they can find the risk in the first place, so they belongs to the inspection personnel. When this type of user login system, they can use the risk entry function of system and the authority of querying some of risk reporting. By the integrated management of work of all kinds of risk management participants when they use the system, each subsystem realized the data sharing function and optimized the business process of risk management, which improved the efficiency and safety level greatly.

4. Risk information database design

The existing railway information system databases are relatively independent, so the data cannot be shared timely, like an island of data. It also leads to the loss of authority and accuracy of the production data. At the same time, the risk factors of railway passenger traffic safety accidents usually distribute widely and various in type. In order to control all kinds of risk factors effectively and timely, and design risk information database based on SQL technology, the database structure should be divided into three parts: data sources, risk categories and problem processing according to the processing steps of risk.
Passenger traffic safety risk information database consists of scene operations, daily inspection of cadres and examination by superior departments or external units. To manage the information database in classification, the filed summarized management, operation, fire & explosion, injury of passenger, work, presentation, food, cash, and the others.

The establishment of passenger safety risk information database can replace the independent databases of the previous business system, which greatly reduced the workload of data statistics and analysis, and also ensured the uniqueness, accuracy and authority of the railway passenger traffic safety risk data as well as providing effective support for the safety management of passenger transport.

5. Conclusion
Based on the characteristics and objectives of railway passenger transport, this paper analyzes the demand of railway passenger safety risk information system systematically and designs the overall framework of the system according to different user requirements. It optimizes the management process of safety risk in passenger production and improves the accuracy of the analysis results.

Design and development of railway passenger safety management information system, which will provide efficient and convenient risk control means for railway safety management personnel to ensure the safe operation, and at the same time, the two main tasks of railway informatization construction and promotion risk theory are completed.

Acknowledgments
This work was supported by a grant from National Railway Administration. The authors would like to thank Kunming Railway Passenger Terminal for excellent technical support and Professor Jia Yuanhua for critically reviewing the manuscript.

References
[1] Li Ke, Jia Guijuan, Shi Yanlin, etc. Analysis and Design of Air Traffic Safety Risk Management Information System. Journal of China Security Science, 19, 2009, pp. 106-111.
[2] Lu Chao, Study and design of management information system for building fire risk evaluation. Yunnan University, Kunming, 2012.
[3] Zhang Hongpeng, Study on Railway Risk Management Method and Information Disposal Platform, China Railway Research Institute, Beijing, 2014.
[4] Liu Aihua. Design of Railway Passenger Transport Section Production Command and Safety Management System, Southwest Jiaotong University, Chengdu, 2014.
[5] Bagheri, Morteza, M. Verma, and V. Veter, A Comprehensive Risk Assessment Framework for Rail Transport of Hazardous Materials, International Conference on Transportation Information and Safety 2011: 2174-2182.