Research on Comprehensive Monitoring System Scheme of Urban Rail Transit Interchange Station

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Abstract: the Safe Operation of Urban Rail Transit Depends to a Large Extent on Intricate Equipment Systems and the Control of Equipment by Advanced Monitoring Systems. in Addition to the Traffic Dispatching System That Has a Direct Relationship with Traffic, the Equipment That Guarantees the Safe Operation of the Subway Also Includes Disaster Prevention Alarm Systems (Fas), Equipment Monitoring Systems (Bas), Power Monitoring Systems (Pscada), Broadcasting Systems (Pa), and Television Surveillance System (Cctv), Access Control System (Acs), Etc. When the Urban Rail Transit System Gradually Enters the Network Operation Phase, Its Monitoring System Must Also Be Adapted to the Needs of the Road Network Operation.

1. Introduction

Interchange stations have a special status and role in the urban rail transit network. With the development of urban rail transit network, the main structure of the interchange station and the design of monitoring functions have become key factors affecting the efficiency and safety of the line network. The impact is mainly reflected in facilities coordination, passenger organization, information sharing, inter-line linkage, etc. aspect. Among them, the integrated monitoring system (ISCS) platform structure and system functions of transfer station nodes must meet the operational requirements of relatively independent operation and management of each line under normal circumstances and unified dispatch and command in disaster situations.

The electromechanical equipment system of urban rail transit involves a wide range, complicated technology, and a large variety of disciplines. The coordination and cooperation of various subsystems and departments can ensure the safety of passengers, the effective operation of trains, and the normal work of equipment. The Integrated Monitoring System (ISCS) came into being. Since the 1980s, many foreign companies have begun to plan and study comprehensive monitoring systems with traffic dispatching commands as the core. At present, foreign subway operation departments have gradually accepted and approved the “comprehensive monitoring system with driving command as the core”, and have formulated corresponding operation scheduling organizations. The integrated monitoring systems used in our country are all integrated monitoring system solutions with ESC and environmental control as the core, and their information exchange with the signal system through interconnection. Domestic researches on integrated monitoring systems are mainly focused on the integrated monitoring system architecture, integration methods, functions, reliability, clock synchronization, etc.

At present, rail transit in some major cities at home and abroad has developed from the past single-line construction to the stage of network construction. The biggest feature of the rail transit network construction process is that the lines intersect with each other to form multiple interchange stations. The convenience and comfort of the transfer stations between the lines in the network is the focus of the majority of passengers. The setup of the interchange station equipment system greatly affects its convenience and comfort. At present, researches on integrated monitoring systems at home and abroad are mostly limited to the entire system of a single line. For this reason, it is necessary to conduct targeted research on the integrated monitoring platform for transfer stations. This article introduces the setting and functional requirements of the station-level comprehensive monitoring system, and gives suggestions for the integration of the weak current system of the comprehensive monitoring platform of the interchange station. Based on this, three schemes for the

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construction of the comprehensive monitoring platform of the interchange station are proposed and compared. analysis.

2. Overview of the Monitoring System

The research on the monitoring system plan is the basis for project decision-making. The necessity of the monitoring system construction should be fully and deeply demonstrated from the national conditions, technology, and economic aspects of China according to the approved project proposal. Its content and depth mainly include: the main technical standards of the system, the main technical equipment design principles, the main project estimates, the main equipment estimates, the main materials estimates, investment estimates, etc. Determine the preliminary opinions on the system functions and composition schemes, the recommended schemes for networking methods, and the recommendations of the operation management system. According to the line network plan, a preliminary plan for mutual transmission of disaster information and coordinated control between lines at the interchange station is proposed.

The application of domestic rail transit monitoring system has evolved from the independent setting of each system to the stage where the systems are integrated, the so-called comprehensive monitoring system. The mainstream solution of the integrated monitoring system is based on FAS, BAS, PSCADA, etc. Due to the content of disaster prevention, starting from the needs of disaster prevention, most integrated monitoring systems are interconnected with PA, CCTV, ACS and other systems, and some have a wider range of integration. However, regardless of whether each system is set up independently or a comprehensive monitoring system, the starting point of the current program research is still the project itself, and there are fewer issues to consider at the level of the road network. For the mutual transmission of disaster information between road networks and the coordination of linkage control The interface schemes are generally not studied in depth. Remediate everything when you encounter an interchange station. In many interchange stations, station-level monitoring systems are set up for each line, and some systems use relay handshake interfaces. The status of the interchange station in the subway system is very special. From the perspective of civil engineering, the interchange station is a whole building. In the event of a disaster, the disaster prevention equipment of the entire station needs to be uniformly dispatched. From the perspective of subway operation, the interchange station is a node station of multiple subway lines. Each line has an impact and must be managed jointly. Therefore, the setting of the monitoring system of the transfer station is very important to the operation of the subway. Obviously, setting up station-level monitoring systems at the interchange stations on each line is not conducive to unified dispatch and unified command of rescue and disaster relief at the interchange stations. At the same time, due to the limited information transmitted by the relay handshake interface, it can not meet the operational management of each line well. In recent years, some cities, such as Beijing and Guangzhou, are constructing urban rail transit monitoring centers (TCC), which further proves that the lines in the road network are not independent but closely related. Therefore, when researching the rail transit monitoring system, it is necessary to conduct research on the level of the road network to make a line monitoring system suitable for the needs of the road network operation.

3. The Station-Level Integrated Monitoring System

The integrated monitoring system uses a universal open hardware interface and software communication protocol to implement information exchange with various weak current systems in an integrated and interconnected manner, and finally achieves centralized monitoring functions of related electromechanical equipment and information exchange and information sharing between systems And coordinate interactive functions. It can quickly and efficiently respond to emergencies such as fires and obstructions, realize the linkage between subsystems, and overcome the shortcomings of the previous “island system”. The integrated monitoring system mostly adopts a layered and distributed structure, with station control as the basic unit, and adopts two levels of management: the control center and the station. Therefore, the integrated monitoring system is

divided into a central-level integrated monitoring system and a station-level integrated monitoring system.

The station-level integrated monitoring platform is the foundation of the entire integrated monitoring system. Its functions are mainly: to realize all the functions of the original station dispatch management; to monitor the information of each interface system; to monitor the environment, disasters, passengers, power supply and The operation of the station's main equipment; control and operation of the station's electromechanical equipment; stop or allow schedules; data processing, archiving, reporting, printing and other services. The construction of the comprehensive monitoring platform for the interchange station should be established as the principle of operation service, equipment maintenance service, and passenger service, and the linkage function should be practical, complete and in-depth. The transfer station comprehensive monitoring platform sharing scheme should be conducive to the integrated monitoring platform to play the role of the information sharing platform, to achieve the station's dispatch management, order management, real-time ticket management and station safety management, to ensure the safety on-board and train arrival and departure safety, and improve The rapid response capability of the system under emergency conditions continuously serves the improvement of operation management throughout the system's life cycle.

4. Ics Structure Design of Transfer Station

The status of the interchange station in the subway system is very special. From the perspective of civil engineering, the interchange station is a whole building. In the event of a disaster, the disaster prevention equipment of the entire station needs to be uniformly dispatched. From the perspective of subway operation, the interchange station is a node station of multiple subway lines. Each line has an impact and must be managed jointly. Therefore, the setting of the transfer station ICS is crucial to subway operation. The transfer modes of the transfer station are roughly divided into platform transfer, station hall transfer, channel transfer, node transfer, mixed transfer, and off-station transfer. The transfer layout includes side-by-side, determinant, cross, T, L, H, etc. According to the different construction cycles and transfer methods, the ISCS setting principles are as follows: (1) Simultaneous construction, shared station hall, platform area public area: It is recommended that the vehicle control room and ICS be set up together. (2) Construction in the same period, the platform, station hall is separated or there is a transfer public area on the station hall floor: It is recommended that the car control room and ICS be separated. Normally, each line operates independently, and the linkage function is realized in the event of a disaster. (3) Construction in phases, sharing station halls and platform-level public areas: It is recommended that the vehicle control room and ICS be expanded from the original line to provide interface conditions for later-built lines. (4) Construction in phases, where the platform, station hall are separated or there is a transfer public area on the station hall floor: It is recommended that the car control room and ICS be separated. Normally, each line operates independently, and the linkage function is realized in the event of a disaster.

In the subway electromechanical system, in addition to traction power supply, shielded doors (PSD), signals and dedicated communications (such as transmission, dedicated telephones, etc.) must be set up on separate lines, the other system design of the transfer station should be based on the transfer mode and operation management requirements Under the premise of ensuring operation security and convenient operation management, follow the principle of setting up resource sharing. The setting principles followed by the transfer station's electromechanical equipment system are as follows: Equipment systems that need to be managed by the same operation and management entity should be co-located with each transfer line as much as possible, that is, unified construction according to the same standards, so that equipment maintenance operations and management standards are unified; For the equipment systems and related facilities managed by different operation management entities, each transfer line should be separated as much as possible so that the management interface is clear. If the responsibilities and management interface between each other are not clear, it will not only reduce the management efficiency, but also cause improper

emergency handling in special circumstances, resulting in personal and property loss and even catastrophic consequences. Each transfer station of Xi'an Metro Line 3 has the following common features: Each transfer line shares the station hall floor of the station, and the station halls are merged or connected through the transfer hall; the space on the platform floor is completely separated, and each line is transferred vertically by an elevator. Or transfer in parallel through the station hall. Under this transfer space condition, it is necessary to determine the main unit of operation and management of this station. The main unit is responsible for the operation and management of the public area of the station hall and the line platform. The non-operation management unit is responsible for the work of the line platform under its jurisdiction.

Based on the setting principles of the interchange station ICS, the division of the operation management interface, and the equipment ownership and system setting methods determined by the management interface, the platform integration system scheme of the interchange station ICS is as follows:

Position the transfer station as a complete station, design and construct simultaneously. A set of ICS is set in the first opened line, and each weak current system of the transfer station is connected to the integrated monitoring platform of the station. The station's ICS is connected to both the local line control center and the later line control center. This solution integrates all operation-related system functions on a human-machine interface.

The original design intention is generally consistent with solution one, and a set of ICS is set up. The difference between the two is that the weak current system must be set up separately according to the line. When the ICS is set up for the first line, it is necessary to reserve the interface conditions with the system related to the later line to integrate the electromechanical systems to which the interconnected line and the transfer line belong.

5. Conclusion

The electromechanical system of the transfer station includes multiple systems such as air conditioning and ventilation, water supply and drainage, fire protection, power supply, and weak current. The integrated monitoring platform can be used to monitor all weak current systems. At present, almost all new rail transit projects choose to build a comprehensive monitoring system, and the station comprehensive monitoring platform has become the development direction of the monitoring system. The construction of the comprehensive monitoring platform for the interchange station can realize the coordinated and unified management of the interchange station equipment, effectively improve the reliability, responsiveness and operating efficiency of the system, and minimize the costs and maximize the operating benefits.

References

[1] GB50366-2010 Engineering Design Specification for Comprehensive Monitoring System for Urban Rail Transit [S].

[2] Wei Xiaodong. Urban Rail Transit Automation System and Technology [M]. Beijing: Electronics Industry Press, 2004.

[3] Xi'an Underground Railway Co., Ltd. Bidding document for the comprehensive monitoring system of the first phase of the project of Xi'an Metro Line 3 (Yuhuazhai-Free Trade Zone) [G]. Xi'an: Xi'an Underground Railway Co., Ltd., 2013.

[4] Yao Guohua, Zhang Ning. Zhang Xiaojun. Construction of integrated monitoring and control platform for urban rail transit interchange stations [J]. Urban Rail Transit Research, 2011 (1): 66.

[5] Zhang Wenji. Analysis of the operation and management interface of metro interchange stations and the setting principle of mechanical and electrical equipment system [J]. Modern Urban Rail Transit, 2010 (1): 45.