Discussion on the construction of intelligent frame repair platform for subway vehicles

Haoran Zhang
Chongqing Vocational Institute of Engineering, Chongqing, China
444719491@qq.com

Abstract. Based on the construction and implementation process of an intelligent management platform for rail transit vehicle maintenance, this paper expounds the construction, implementation and application of the intelligent management platform for rail transit vehicle maintenance in view of the development status of the operation and maintenance of rail transit vehicles in our country, so as to provide reference for relevant professionals of rail transit.

1. Introduction
In recent years, with the strong support of the national policy, the rail transit industry is developing all over the country. New rail transit lines have been put into operation in major and medium-sized cities. The network in Beijing, Shanghai and other cities has reached more than 700 kilometers, and the lines in Nanjing, Wuhan, Chengdu and Chongqing have exceeded 300 kilometers. At present, the operating distance or operating life of quite a few rail transit vehicles in major cities has been approaching 600,000 km or five years, and they are about to enter the stage of vehicle repair. From the perspective of industry dynamics, the vehicles of Chongqing rail transit, Chengdu metro, Beijing metro, Guangzhou metro and other rail operation and maintenance companies have entered the repair process. Train frame repairs can be as short as half a month, or as long as more than a month. The manpower, material resources, financial resources and working hours consumed during the frame repair process; The coordination factors of quality card control and working procedure implementation in the frame repair process affect the quality, time limit and cost of the frame repair of subway trains. With more and more vehicles entering the frame repair process, the construction period, quality and cost must be controlled effectively. Reasonable management of human resources, materials and other factors, in order to ensure the quality and quantity of the completion of the task, to ensure the quality of vehicles, to ensure the sufficient supply of trains. In the complex and long lasting repair process, the use of digital and intelligent means to manage the repair process, scientific and reasonable management of human resources, materials, vehicle quality, vehicle repair process, has become the focus of rail transit operation and maintenance enterprises to study.

2. Construction objectives
Rail transit vehicle frame repairing intelligent management platform construction to manage the process of transparent, visual, desirable, and data services intelligence as a strategic goal, on raising the management level, improve employee productivity and improve the quality of vehicle frame repairing reliability, in order to curing maintenance procedures, work order process, operation form, etc., let the
equipment overhaul standardization, streamline, standardization, refinement and implementation frame of vehicle inspection trim intelligent management, improve the quality of vehicle maintenance, prolong the life cycle of the vehicle.

3. implementation plan

3.1. Overall process planning
(1) the existing safety, quality, technology, materials, repair procedures, all relevant documents for sorting; Sorting out the on-site shop repair process and relevant data forms; Sort out the working process of the vehicle repair department, vehicle operation management and superior department. The principle of carding should take the management documents of shelf repair as the constraint rules and reasonably arrange the workflow process with all levels of units.

(2) the scheduling arrangement of vehicle delivery plan, vehicle delivery inspection link, vehicle repair link, vehicle delivery management and other process links one by one comb, form a visual flow chart file, and comb out all the documents in one by one map.

Figure 1. Hierarchy process

(3) according to the process, the formation of a visual flow chart, and in accordance with the relevant process constraint documents, frame repair procedures as the premise, the constraints one by one and the process corresponding, at the same time according to the requirements of the rules, in advance to design the data table and the corresponding work sequence. And the corresponding working hours, quality card control, tools and materials window in each working procedure.

Through the above steps to form the overall process of the frame repair platform, the formation of the overall frame repair top blueprint.

3.2. formation stage
The professional technical team of components communicated, investigated and visited relevant functional departments of frame repair, vehicle operation departments, business contact enterprises, and experienced professional consulting agencies to understand the demand composition and ideal management mode within the frame repair industry chain. The focus is to conduct in-depth research on the business model and management mode proposed by the company’s internal functional departments and vehicle operation and maintenance departments, so as to serve as a weathervane for the platform construction and gradually improve the top-level construction plan. Fully consider the top-level design of intelligent operation and maintenance of rail transit of the group company, and reserve the interface of information interconnection with other majors such as signal and communication in advance. After the stable application of the system, the interconnection between platforms can be further studied to gradually realize the full professional intelligent operation and maintenance platform of rail transit.

(1)Working process design: the initial formation of the flow chart in 2.1 content changes, from the system integrity and management group within the department documents binding conditions, guarantee the science, the rationality of the process, always in accordance with the functions of management, vehicle scheduling department—vehicle operations—vehicle repair department —Metro operation
department as the main line, in the form of a flowchart full amount chemical relationship. For example, single transfer of information is not allowed without a reasonable closed-loop form.

(2) Function quantization: according to the design of the work flow, the function of the information platform is put forward to form the intelligent platform model of quantization of rack and repair data and visualization of operation.

(3) Hardware quantitative design: according to the needs of the information data of the shelf repair, the terminal equipment on the workshop site, the control terminal of the operating platform, the operating terminal, the server and so on carry out quantitative design, determine the number of hardware platforms, specifications, place, etc.

3.3. platform formation stage
According to the workflow and software design, the platform is built for informatization, and the workflow of each link is mapped one by one.

Form the platform frame of intelligent frame repair platform

![Figure 2. Visual interface](image)

3.4. formation and implementation of platform data system
Step 1: implement team according to a list of repair complete subway repair procedures, subway repair process will trim the human resources management files, frame, frame materials such as dissected into text information, such as quality locus of control, work instructions, procedures, subway repair record table, repair tools, processes, etc., according to the workflow of the platform system, complete input system, forming a column repair complete initial data content, forming subway maintenance template.

Step 2: implement team, in strict accordance with the subway repair template to a repair shop for test site, with the entry of subway repair test template, from the functional management department-subway scheduling department-subway operations-subway repair department - subway repair after subway department of complete process test a list of repair, the science, the rationality of the debugging process, the error or unreasonable place in improvement. Focus on debugging the process of frame repair, test the process of frame repair order, process labor, process instructions, process quality control point of process for strict testing, after debugging a train, quickly promote the whole train until the entire network of frame repair train.
4. Application of intelligent frame repair platform

4.1. Frame repair view management
Rail transit operating enterprises have the characteristics of scattered rolling stock, which cannot monitor the vehicle frame repair in real time, but can observe the overall working status of each line frame repair workshop at any time from the frame repair kanban. The information of the repair progress, the number of working hours consumed, the expected completion time, key technologies and key card control quality of each frame repair vehicle can realize unified supervision and control management of the frame repair vehicle of the wire network from a global perspective.

4.2. Plan management
The number of running kilometers of the operating vehicles of rail transit is constantly changing, so the system automatically arranges the rack repair plan according to the characteristics of the running vehicles.

4.3. Transfer vehicle management
From the planned entry of the train, to the train storage of the link, there are generally functional departments, vehicle operation and maintenance departments, vehicle repair departments involved. In the process of vehicle delivery, the intelligent frame repair platform is used to deal with the work content and authority of relevant departments, to complete vehicle delivery management quickly and reasonably, and to form visual archiving information for convenient management.

4.4. a repair list
Using the standard car repair template of intelligent frame repair platform, the requirements of a train's frame repair can be quickly configured, including working hours, working procedure, working procedure maintenance standard and quality card.

4.5. Automatic scan code and APP application
Intelligent frame make the platform based on hardware and software equipment to complete the whole operation, sweep through offline code can see complete failure is allowed, overhaul plan, work order issued claim, task scheduling, homework fill, different positions and obtain the corresponding scope of authority, etc, to establish a complete, more levels of management model, based on the measurement system, the fault system, security system and so on quality assurance period, provide status early warning analysis, maintenance decision analysis from multiple perspectives such as the technology optimization analysis.

4.6. Problem tracking management
Carry out real-time tracking and management of key fault equipment and other problems of vehicles, ensure the formation of closed loop with guaranteed quality and quantity in accordance with agreed rules, timely deal with difficult and miscellaneous problems in the maintenance process, and realize problem zero management.

4.7. Resume management
To realize the process management of the hardware equipment of the vehicle set, the vehicle can inquire the resume data according to the train number, vehicle type, parts and so on, so as to have a comprehensive understanding of the vehicle.

A railway operation enterprise began to promote vehicle intelligent rack repair in 2017, and has now covered the rack repair vehicles of line 1, line 2, line 3 and line 6. Content mainly includes the vehicle management, aircraft repair process management, human resources, material and data management, application development and APP automatically scan code inspection car, and other functions, subsequent gradually achieve each line, each workshop system upgrades, perfect the handheld devices
such as terminals, the machine configuration, optimization of employees' operation experience, improve the information service ability of rail operators.

5. conclusion
Through the construction of rail transit vehicle intelligent management platform frame, and can effectively improve the quality of management of aircraft repair, repair quality, can be quickly in cost accounting, human resources, material management, through the frame of data management fast alignment with the maintenance of the routine weak spot, to track the frame of the enterprise management to provide accurate the swimmer. The introduction of shelf repair management informationization is not only the application of information technology, but also the hidden enterprise management thought. It can achieve the standardization, process, standardization and refinement of vehicle shelf repair management, which is a subversive change.

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