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Research on revision of relevant provisions of high-speed railway emergency disposal in the regulations on railway technical management (RRTM)

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Abstract

Purpose – This study aims to improve the rules and regulations system of high-speed rail emergency disposal.
Design/methodology/approach – Based on the analysis of the demands, rules and regulations of China concerning on-site high-speed rail emergency disposal, basic principles for revising the regulations on railway technical management (RRTM) are proposed and suggestions and evaluation methods according to the main clauses are put forward.
Findings – Basic principles for revising the RRTM are proposed, namely "to meet the actual needs of on-site high-speed railway emergency disposal, standardize the emergency disposal process, improve the efficiency of emergency disposal and keep the consistency between provisions of emergency disposal". Existing provisions related to emergency disposal efficiency, scenarios, safety and service quality are made up for the deficiencies. To make up for the deficiencies of the existing provisions related to emergency disposal efficiency, improvement of emergency disposal scenarios and guarantee of emergency disposal safety and quality, this paper puts forward suggestions on revising 15 emergency disposal provisions of the RRTM with regard to earthquake monitoring and warning, in-station foreign body invasion warning, air conditioning failure of EMU trains and forced parking of trains in sections. A fuzzy comprehensive evaluation model based on the analytic hierarchy process (AHP) is constructed to evaluate the proposed revision scheme and suggestions, which has been highly recognized by experts.
Originality/value – This study implements the goal of high-quality railway development.

Keywords RRTM, High-speed railway, Emergency disposal, Clause revision, AHP
Paper type Research paper

1. Introduction

In recent years, China has undergone a rapid development in high-speed railways. As of the end of 2022, the operating mileage of high-speed railways in China reached 42,000 kilometers. High-speed railways play an increasingly important role in transportation of massive passengers. At the same time, passengers are raising an increasing demand for on-time departure of high-speed railways and their quick and effective response to any emergency. In order to promote the high-quality development of railways, China State Railway Group Co.,

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Ltd. made clear in the 2019 Railway Work Report that it was necessary to study and formulate the regulations on high-speed railway emergency disposal, to improve the emergency response plan and to organize practical drills, so as to improve the level of high-speed railway emergency disposal (Jia, 2020). At present, a system of step-by-step high-speed railway emergency response under the unified command has been established in China. Specifically, in the event of any railway emergency, various specialist agencies carry out emergency disposal work under the guidance of emergency command centers at all levels. However, many problems exist in regulations on high-speed railway emergency disposal. Specifically, related rules and regulations need to be established and improved to avoid the problems including low efficiency of high-speed railway emergency disposal, lack of related regulations regarding some common emergency problems, nonconformance to actual conditions and non-standardized management (Liu & Yin, 2020).

In this context, this paper studies and proposes the principles and suggestions for revising the provisions of high-speed railway emergency disposal in the RRTM and constructs an index system and model for evaluation of emergency disposal provisions.

2. Basic principles for revising relevant provisions of high-speed railway emergency disposal

The RRTM (high-speed railway part) consists of four chapters and 118 articles compiled by 33 emergency disposal scenarios, including operating in case of disastrous weather or equipment failure, organization for abnormal operating, rescue, etc. In order to improve the efficiency of on-site emergency disposal, this section proposes the basic principles for revising the RRTM according to the development status of railway technology and equipment.

2.1 Meeting the actual needs of on-site emergency disposal

Due to the continuous evolution of railway technology, equipment and emergency organizations, some provisions of the RRTM no longer meet on-site emergency disposal needs. Thus it is necessary to revise and improve some urgently needed on-site emergency disposal provisions tested to be mature and reliable, to fully summarize the experience of on-site emergency disposal and the application of advanced technology and equipment and to give full play to the overall role of the RRTM in ensuring the safety and efficiency of railway transportation and production (Lu, 2019).

2.2 Standardizing the high-speed railway emergency disposal process

For the same scenario of high-speed railway emergency disposal, handling procedures specified in different regulations might be different. In view of this, emergency disposal procedures in the RRTM should be revised and improved. Also, other related regulations should be consistent with the relevant provisions of the revised RRTM to further standardize high-speed railway emergency disposal.

2.3 Improving the efficiency of high-speed railway emergency disposal

Some provisions in the RRTM (high-speed railway part) affect the efficiency of on-site emergency disposal to some extent (Yin & Liu, 2018). For example, the provisions on train speed limiting for emergency scenarios need to be further optimized. On the principles of safe, efficient and controllable high-speed railway emergency disposal, it is necessary to improve the efficiency of emergency disposal and optimize the transportation order and passenger service quality under abnormal circumstances while fully ensuring safety (Tang, Li & Zhou *et al.*, 2023).

2.4 Keeping the consistency between provisions of emergency disposal

Some provisions that are inconsistent with relevant standards, specifications and regulations are revised to ensure the consistency between the RRTM and relevant national standards and design specifications. In addition, some contents approved by China State Railway Group Co., Ltd. that may be inconsistent with the RRTM and have been implemented in some regulations are included, to enhance the consistency of emergency disposal regulations.

Therefore, the revision principles of "to meet the actual needs of on-site high-speed railway emergency disposal, standardize the emergency disposal process, improve the efficiency of emergency disposal and keep the consistency between provisions of emergency disposal" are proposed and finalized. According to the effects of enhancing efficiency and benefits, revision suggestions on emergency disposal are divided into four categories: optimizing emergency scenarios, improving emergency efficiency, ensuring emergency safety and guaranteeing service quality (Wang & Zhou, 2023).

3. Suggestions on revising relevant provisions of high-speed railway emergency disposal

3.1 Improving the efficiency of high-speed railway emergency disposal

Too cumbersome emergency disposal procedures stipulated in Articles 216, 259, 278, 313, 393, 398 and 427 of the RRTM need to be simplified and optimized to improve the emergency disposal efficiency.

3.1.1 Optimizing the handling procedures for emergency braking or forced parking within tuning areas. A train should be moved (no parking in the tuning area) if possible while ensuring the operation safety of the train. In addition, the use of short-circuited copper wires for short connection to track circuits outside the tuning area is suspended to improve the efficiency of emergency disposal. However, in reality, drivers neither can know the accurate locations of subsequent trains nor can notify them in time. Therefore, the instructions for informing subsequent train drivers of the current location should be deleted, but the provisions on use of LBJ protection warning or CIR 299 group call warning should be added. Moreover, the driver must immediately report an exception (if any) to the train dispatcher or station attendant for unified command, so as to leave more time for emergency disposal by the driver.

3.1.2 Adding the handling procedures for temporarily irreparable automatic braking failures in a passenger train section. According to existing provisions, when a passenger train encounters any temporarily irreparable automatic braking failure in a section, the last car cannot have a closed angle cock. However, the measures for disposal when the door of the last car with closed angle cock has to be closed due to such automatic braking failure are not specified.

Therefore, it is suggested that when the last car encounters any temporarily irreparable automatic braking failure in a section, door closing is allowed according to relevant provisions. In addition, to ensure the safety of door closing, train crews are recommended to stay at the rear of the car. Due to the influence of bridges, tunnels and other factors, train crews are exposed to personal safety hazards when handling failures. In order to ensure that the train does not slip, it is suggested to park at the front station for better handling (Letter from China State Railway Group Co., Ltd. NO.131, 2015).

3.1.3 Clarifying the use of master auxiliary button without issue of dispatching commands. With the development of technology, existing communication means can ensure the effective transmission of commands. In addition, the system counter and recording through Yuntong 46 ensure authenticity and effectiveness of information acquired. In addition, only train dispatchers and station attendants are authorized to issue dispatching commands through the master auxiliary button, with a small transmission range and relatively fixed personnel composition. Therefore, issuing the dispatching commands has no obvious effect, but undermines efficiency due to increase of emergency disposal procedures. It is suggested that the stations use the master auxiliary button without issuing of dispatching commands.

3.1.4 Optimizing the provisions on speed limiting in the dispatching command in case of failure in train speed limit setting. In reality, the distance between high-speed railway stations is generally long. For example, the distance between Tai'an Station and Qufu East Station of Beijing–Shanghai high-speed railway is about 70 km. If an EMU train runs at a speed of 40 km/h specified in existing provisions, it takes as long as nearly two h, thus seriously interfering with the operation of other trains. What is worse that the EMU train cannot automatically pass through the phase break of overhead contact system in a district with a certain slope when running at 40 km/h. Therefore, it is suggested to cancel the maximum speed limit of 40 km/h. In addition, to improve the efficiency of emergency disposal, for EMU without LKJ, a driver only needs to verify the operation disclosure dispatching command upon receiving it before departure, and the dispatcher will no longer issue any speed limit dispatching command.

3.1.5 Adding disposal measures for foreign object hanging on the pantograph and automatic pantograph lowering during operation. In real scenes, most foreign objects hung on the pantograph are small things such as plastic bags, so damage to the pantograph is usually not severe after automatic pantograph lowering. In other words, the train can continue to run through speed reduction, pantograph replacement and other means. However, existing provisions stipulate that parking in a section is required for disposal, which has a significant impact on transportation organization.(Yang, 2022) Therefore, better emergency disposal means should be adopted, to reduce interference with the transportation order on the principle of "continuing to operate if possible, and disposing at the front station as much as possible". Therefore, it is suggested to: (1) add relevant requirements for disposing of foreign objects hung on the pantograph without the need to climb to the top; (2) add relevant requirements for continuing operation through speed reduction and pantograph replacement, without the need to climb to the top for disposal.

3.1.6 Optimizing the process of remote power transmission to the neutral zone when the train stops in the dead zone of overhead contact system phase break. In existing provisions, the train dispatcher should submit an application for cutting power of the feeding section of overhead contact system behind the phase break to the load dispatcher, and then handle procedures for remote power transmission to the neutral zone. In order to improve the efficiency of emergency disposal, it is suggested to simplify the process of remote power transmission to the neutral zone through one-off power outage and transmission.

3.2 Improving emergency scenarios

In view of incomplete emergency scenarios mentioned in Articles 343, 351, 354 and so on of the RRTM, suggestions for improving corresponding emergency disposal provisions are put forward based on the application of new technology and equipment and according to unclear emergency disposal requirements in the original provisions.

3.2.1 Optimizing the speed limit requirements for EMU trains in windy weather. When an EMU train runs at a ceiling speed of 310 km/h or 210 km/h, warnings are given frequently due to the so-called overspeed under strong wind warning conditions. Moreover, the strong wind warning message is mainly manually dealt with by the train dispatcher; therefore, the problem of failing to deal with in a timely manner occurs sometimes.

Relevant statistics show that after the wind monitoring system sends a strong wind warning message, it takes at least about 85 seconds for the train dispatcher to inform the driver of the first EMU train to limit the speed by telephone. In contrast, the train dispatcher needs to spend as long as about 2-3 minutes to notify the driver through the CTC terminal or dispatching command. Of course, more time is needed for subsequent trains. Take Hada No.1 Station of China Railway Shenyang Bureau Group Co., Ltd. as an example. On a windy day, 1,005 primary warning messages and 291 secondary warning messages were sent. The speed limits for them are 300km/h and 200km/h, respectively. However, the train dispatcher failed to promptly notify the drivers due to frequent warning, resulting in that the trains continued to run at a ceiling speed of 310 km/h in this district, rather than of the prescribed 300 km/h.

Therefore, it is suggested to add relevant requirements for normal operation of railway lines with ceiling speeds of 310 km/h and 210 km/h.

3.2.2 Adding relevant requirements for in-station foreign object invasion warning. Existing provisions stipulate the disposal methods for intra-section foreign object invasion warning, but the methods for in-station foreign object invasion warning. Therefore, it is suggested to add the requirements for in-station disposal: "when an in-station foreign object invasion warning is given, it is necessary to promptly notify any train having entered the warning location to stop immediately and to no longer allow any train to march toward the nearby track circuit district."

3.2.3 Optimizing the disposal procedures for earthquake monitoring and warning. Existing provisions stipulate that upon receiving an earthquake (regardless of any magnitude of the earthquake) alarm message or on-site earthquake report, the train drivers should stop the trains for inspection, which will have a significant impact on the order of high-speed railway transportation.

According to the interim provisions on post-earthquake emergency disposal of high-speed railway infrastructure (Letter from China State Railway Group Co., Ltd. NO.77, 2019), different measures may be taken according to different earthquake magnitudes and distances from the epicenter, which improves the pertinence of post-earthquake emergency disposal and reduces the impact of earthquake on the order of high-speed railway transportation while ensuring safety. An earthquake warning system as a product of technical development has been installed for some high-speed railways, which enables post-earthquake emergency disposal through the emergency disposal function thereof (Zhu, 2022).

Therefore, it is suggested to change the requirement of "upon receiving an earthquake (regardless of any magnitude of the earthquake) alarm message or on-site earthquake report, the train drivers should stop the trains for inspection" to "notifying drivers to stop trains or drive at limited speeds according to relevant provisions" (Chen & Jiang, 2013). Also, it is suggested to add emergency disposal requirements for the lines equipped with the earthquake warning system.

3.3 Emergency safety guarantee

In view of potential safety risks of emergency disposal mentioned in Articles 346 and 349 of the RRTM, it is suggested to revise relevant provisions to enhance the safety of emergency disposal.

3.3.1 Optimizing the procedures for emergency disposal by drivers in case of sudden situations such as line collapse. In existing provisions, in case of emergency, a driver needs to notify the drivers of tracking and adjacent trains. However, in fact, the driver cannot know the accurate information of such trains and can only inform them through the function of LBJ protection warning or CIR 299 group call warning. Therefore, it is suggested to delete the existing requirements for notifying tracking and adjacent trains. When any emergencies that endanger train safety such as line collapse or ballast bed washaway occur, the train driver should immediately take emergency safety measures, give an alarm through the train protection alarm device (if there is no train protection alarm device or the device malfunctions, use the CIR "group call" function) and notify the train dispatcher (adjacent stations).

3.3.2 Adding the requirements for train operation organization in case of overhead contact system icing and trail swaying in ice and snow weather. Some effective measures for prevention and reduction of ice and snow disasters have been summarized in recent years. For example, when an EMU train (electric locomotive) cannot raise the pantograph for operation after overhead contact system icing or trail swaying, the train is allowed to continue running through many means such as suspended operation of overhead contact system (part), idle running of the EMU train (electric locomotive) after pantograph lowering and internal combustion locomotive ferry (Letter from China State Railway Group Co., Ltd. NO.23, 2018), which is of great significance to ensure driving safety and smooth transportation in severe weather conditions. Practice has proven that this approach is mature and effective. Therefore, it is suggested to add and solidify this approach at the regulatory level.

3.4 Service quality assurance

In order to prevent potential decline of passenger service quality in the emergency disposal process mentioned in Articles 403, 404 and 405 of the RRTM, and part of existing provisions do not accord with actual applications on site, the provisions on air conditioning failure, protective net installation and door-opening speed limitation for EMU trains are improved.

Firstly, an actual test of a CRH1A EMU train was performed near Dazhou Station of Dazhou–Chengdu railway in 2010, which was witnessed by about 80 participants. Testing results show that at an external temperature of 33℃, the participants felt uncomfortable five min later after the central air conditioner was turned off and even felt turbid, stuffy and unbearable about ten min later. If the central air conditioner of the EMU train malfunctions for more than 20 minutes (threshold), passengers might have heatstroke, because air quality in the cars will rapidly deteriorate in a short period of time due to good airtightness in hot weather. In recent years, some passengers ever suffered from heatstroke in the EMU trains because drivers strictly followed the 20 minute limit requirements after air conditioning failure during the hot season. In accordance with the notice of the Transportation Bureau of China Railway Corporation on strengthening safety management of passenger trains (Letter from China State Railway Group Co., Ltd. NO.1697, 2015), emergency disposal in case of air conditioning failure is not subjected to the 20 min limit.

Secondly, installing protective nets in advance can shorten the time for door opening and ventilation, which helps to solve the problem of air conditioning failure in a more flexible and effective manner, thus avoiding serious consequences. Currently all EMU trains have built-in protective nets that can be installed in the door-closing state. During the joint debugging and testing of EMU trains along new lines, various railway bureaus provided training on the installation and operation of protective nets (Sun, 2021), finding no problems affecting safety. In addition,

Thirdly, the speed limit of 60 km/h in the door-opening state in case of air conditioning failure will make the operating duration longer, which will reduce passenger comfort and even cause the risk of being unable to automatically pass through the phase break. Therefore, the speed limit in the door-opening state should be increased to 80 km/h.

Fourthly, some EMU trains are equipped with outward-opening sliding plug doors, which may result in the overrun state when opening the door. To prevent accidents caused by collision with the platform, doors should be closed when the train approaches the station and then, be opened after the train leaves the station and stops (Letter from China State Railway Group Co., Ltd. NO.140, 2017).

Therefore, it is suggested to: (1) cancel the requirements for disposal after 20 min of failure; (2) change the speed limits in case of air conditioning failure of EMU trains; (3) allow the installation of protective nets without stopping; (4) add relevant requirements for the operation when outward-opening sliding plug doors are opened.

4. Research on the method for evaluating the revision scheme based on AHP

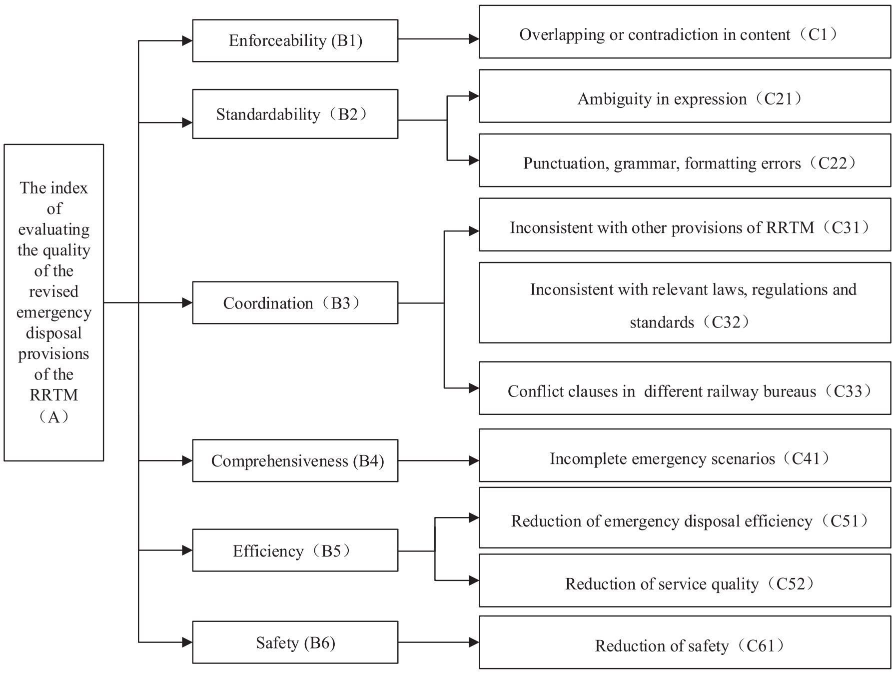
The revision of the RRTM involves train operation organization, technical equipment, signal display and other aspects. Each article thereof is formulated based on the actual conditions of on-site emergency disposal. In addition, the quality of revision is difficult to be evaluated based on unified quantitative standards. The fuzzy comprehensive evaluation method based on the AHP organically combines qualitative and quantitative analyses, and is suitable for evaluating complex systems with multiple objectives, multiple criteria and difficulty of fully quantifying (Fu, 2013). Therefore, a fuzzy comprehensive evaluation model based on the AHP is constructed to evaluate the proposed revision scheme.

4.1 Quality evaluation indexes

The revision quality evaluation index system consists of the system layer, principle layer and index layer, as shown in Figure 1. Specifically, the system layer is the overall system of evaluation, representing the index of evaluating the quality of the revised emergency disposal provisions of the RRTM; the principle layer indicates the principles for revision of the RRTM, including enforceability, standardability, coordination, comprehensiveness, efficiency and safety.

4.2 Comprehensive evaluation model

The AHP is used to compare the evaluation indexes at each level. According to discussion results of ten experts in the field of railway technical regulation management, an evaluation index judgment matrix is constructed (see Tables 1–4). Because there is only one index under the options of “enforceability (B1)” “comprehensiveness (B4)” and “safety (B6)” and the weight of the index layer against the principle layer is 1; there is no judgment matrix for each index in the index layer). Whereas the issues such as “overlapping or contradiction in content”, “reduction of emergency disposal efficiency” and “reduction of safety”, are relatively serious and have a significant impact on the quality of revision, higher weights are



Source(s): Authors’ own work

Figure 1. Indexes for evaluating the quality of revision of the RRTM

set for corresponding evaluation indexes. The sum-product method is used to calculate the vectors of weight at each level, and on this basis, the weights of the indexes for evaluating the quality of revising the emergency disposal provisions in the RRTM are finally determined. To keep the consistency of the judgment matrix proposed by experts, consistency testing is required. If the consistency index of the judgment matrix is CI_i, the average random consistency index is RI_i and the random consistency ratio is CR_i, then:

$$CR_i = \frac{CI_i}{RI_i} = \frac{\lambda_{\max i} - n}{(n-1)RI_i} \tag{1}$$

Where $\lambda_{\max i}$ is the maximum eigenvalue of the ith judgment matrix and n is the order of the matrix.

It can be seen from Tables 1–4 that the consistency ratio of each judgment matrix is less than 0.1, indicating that the judgment matrices meet the consistency condition. The obtained feature vector is the weight vector corresponding to an evaluation index.

According to the system for evaluating the quality of revising the emergency disposal provisions of the RRTM as well as the weights of corresponding indexes, a multi-level fuzzy evaluation method is adopted to construct a fuzzy comprehensive evaluation model. The indexes of the system layer and principle layer are divided into three levels: excellent, good and passed. The evaluation set Q = {90 (excellent), 80 (good) and 60 (passed)}. Based on the subordinating degree function, the index membership matrix for the principle layer and system layer is constructed as follows:

Table 1.
A-B_i judgment matrix

A	B_1	B_2	B_3	B_4	B_5	B_6	Weight W	Consistency verification
B_1	1	3	3/2	3	3/4	3/4	0.2000	$CR = 0 < 0.1$
B_2	1/3	1	1/2	1	1/4	1/4	0.0667	
B_3	2/3	2	1	2	1/2	1/2	0.1333	
B_4	1/3	1	1/2	1	1/4	1/4	0.0667	
B_5	4/3	4	2	4	1	1	0.2667	
B_6	4/3	4	2	4	1	1	0.2667	

Table 2.
B_2-C_{2j} judgment matrix

B_3	C_{21}	C_{22}	Weight W_2	Consistency verification
C_{21}	1	2	0.667	$CR = 0 < 0.1$
C_{22}	1/2	1	0.333	

Table 3.
B_3-C_{3j} judgment matrix

B_3	C_{31}	C_{32}	C_{33}	Weight W_3	Consistency verification
C_{31}	1	3	3/2	0.5	$CR = 0 < 0.1$
C_{32}	1/3	1	1/2	0.167	
C_{33}	2/3	2	1	0.333	

Table 4.
B_5-C_{5j} judgment matrix

B_5	C_{51}	C_{52}	Weight W_5	Consistency verification
C_{51}	1	2	0.667	$CR = 0 < 0.1$
C_{52}	1/2	1	0.333	

Source(s): Authors' own work

$$R_i = \begin{bmatrix} r_{11} & \cdots & r_{13} \\ \vdots & \ddots & \vdots \\ r_{n1} & \cdots & r_{n3} \end{bmatrix} \quad (2)$$

Where R_i is the index membership matrix; and r_{ij} represents the probability of rating indexes A_{ij} and B_{ij} as Q_j.

The fuzzy membership matrix L_i of indexes is as follows:

$$L_i = W_i \cdot R_i \quad (3)$$

4.3 Application of evaluation methods

Taking earthquake monitoring and warning as an example, the evaluation process is described. According to scores given by ten experts in the field of railway technical regulation management after evaluating the quality of the revision scheme, the fuzzy membership degree corresponding to each index in the index layer is obtained, with details shown in Table 5. The fuzzy membership degree of the principle layer indexes is calculated according to equation (2), as shown in Table 6.

On this basis, the fuzzy membership degree L_{system} of the system layer is calculated to be {0.896, 0.104 and 0}according to equation (3). The comprehensive value $F_{\text{Article 354}}$ of evaluating the quality of revising Article 354 of the RRTM is calculated to be $F_{Article\,354} = L_{system} \cdot Q^T = 88.96$.

Similarly, the comprehensive values of evaluating the quality of revising emergency disposal provisions of the RRTM are calculated, as shown in Table 7.

Membership degree	Indexes	Excellent	Good	Passed
RB_1	C_{11}	0.9	0.1	0
RB_2	C_{21}	0.8	0.2	0
	C_{22}	1.0	0	0
RB_3	C_{31}	0.9	0.1	0
	C_{32}	0.7	0.3	0
	C_{33}	0.8	0.2	0
RB_4	C_{41}	0.8	0.2	0
RB_5	C_{51}	0.9	0.1	0
	C_{52}	1.0	0	0
RB_6	C_{61}	0.9	0.1	0

Source(s): Authors' own work

Table 5. Membership degrees of indexes for evaluating the quality of revising the earthquake monitoring and warning provisions in Article 354 of the RRTM

Membership degree	Indexes	Excellent	Good	Passed
LB_1	B_1	0.900	0.100	0
LB_2	B_2	0.867	0.133	0
LB_3	B_3	0.867	0.133	0
LB_4	B_4	0.800	0.200	0
LB_5	B_5	0.933	0.067	0
LB_6	B_6	0.900	0.100	0

Source(s): Authors' own work

Table 6. Fuzzy membership degrees of principles for evaluating the quality of revising the earthquake monitoring and warning provisions in article 354 of the RRTM

Table 7. Comprehensive values of evaluating the quality of revising emergency disposal provisions of the RRTM

No.	Emergency disposal provisions of the RRTM	Evaluation value
1	Article 216	87.9
2	Article 259	89.6
3	Article 278	88.1
4	Article 313	89.3
5	Article 343	88.5
6	Article 346	89.1
7	Article 349	87.9
8	Article 351	89.2
9	Article 354	88.9
10	Article 393	89.7
11	Article 398	89.8
12	Article 403	88.9
13	Article 404	88.9
14	Article 405	88.9
15	Article 427	89.1

Source(s): Authors' own work

It can be seen that the scores of evaluating the quality of revising emergency disposal provisions of the RRTM are all above 87.0, indicating that most experts hold that the revision quality is good, recognizing the revision scheme in enforceability, comprehensiveness, standardability, coordination, efficiency and safety.

5. Conclusions

Based on the basic principles of "to meet the actual needs of on-site high-speed railway emergency disposal, standardize the emergency disposal process, improve the efficiency of emergency disposal and keep the consistency between provisions of emergency disposal", this paper puts forward the suggestions on revising 15 emergency disposal provisions of the RRTM with regard to earthquake monitoring and warning, in-station foreign body invasion warning, air conditioning failure of the EMU trains and forced parking of trains in sections. A fuzzy comprehensive evaluation method based on the AHP is used to construct an index system and model for evaluation of emergency disposal provisions in the RRTM. In addition, the 15 revision suggestions are evaluated and analyzed one by one. Evaluation results show that the suggestions for revision of emergency disposal provisions in the RRTM are beneficial for improvement of emergency disposal efficiency and scenarios and guarantee of emergency disposal safety and quality, and are highly recognized by experts.

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