

Construction and Application of Evaluation Index System of Transportation Emergency Management

Yue Shao*

China Academy of Transportation Sciences, Beijing 100029, China

shaoyue_2022@outlook.com

**Corresponding author*

Keywords: transportation, emergency management, index system, evaluation

Abstract: This paper realizes the research and judgment of the transportation emergency management situation and emergency capability level, clarifies the connotation of the transportation emergency management system, combines the components of the transportation emergency management system and the emergency process, and establishes the transportation emergency management evaluation index system. The scoring and application of the method verifies the rationality and effectiveness of the indicator system, provides a foundation for supporting the construction of the transportation emergency management system, and improves the transportation emergency management level.

1. Preface

In recent years, with the rapid economic and social development and the improvement of people's living standards, the rapid improvement of motorization level and the further increase of traffic flow, higher requirements have been placed on the emergency response capability of transportation, and the situation facing public safety and emergency management is more severe.

Transportation emergency management plays an increasingly important role in the emergency response to all kinds of major emergencies, and has been affirmed many times by the leaders of the CPC and the State Council. However, there are still some problems in the construction of the emergency management system, such as the insufficiency of the construction and management of the emergency plan, and the weak link in the construction of the emergency response capacity. The emergence of these problems also reflects the shortcomings of transportation emergency management. How to evaluate the emergency management situation and provide support for the construction of transportation emergency response capacity is an urgent problem to be solved.

As far as emergency management is concerned, it is the earliest in foreign countries, and the emergency management evaluation and indicator system is the most complete. In 1997, the Federal Emergency Management Agency of the United States jointly developed a relatively comprehensive evaluation system, focusing on 13 management functions of emergency management[1]. Japan has developed evaluation criteria and methods for disaster prevention and crisis management capabilities. The establishment of the US evaluation index mainly focuses on the evaluation of emergency preparedness capability, while Japan's emergency capability evaluation index lacks the evaluation of command and decision-making capability. Many studies on emergency management

and capability evaluation have also been carried out in China, which are used in maritime search and rescue[2], road traffic[3], civil transport airports[4], and railway enterprises[5]. In addition, the Safety and Resilience Emergency Management Capability Assessment Guide (China Standard GB/T 40151-2021) provides four maturity levels, eight indicators, and an assessment process. At present, most of these studies are concentrated in a certain field, such as waterways, highways, etc., and there is a lack of indicators to judge the level and situation of transportation emergency response capabilities as a whole, and a national top-level design is lacking[6-9].

In order to improve the level of transportation emergency management, support the construction of the transportation emergency management system, and initially realize the research and judgment of the transportation emergency management situation and emergency capability level, on the basis of clarifying the connotation of the transportation emergency management system and the functions of the evaluation index system, this paper analyzes the based on experience, comparative analysis and other methods, construct a traffic emergency management indicator system[10][11].

2. System connotation and index function

2.1 Connotation of transportation emergency management system

At present, China's theoretical circles and practical departments have not yet carried out a scientific and authoritative definition of "emergency management system", and there are few definitions that have not completely consistent with the connotation and extension of "emergency management system"[12][13]. However, its meaning and composition are not unified, and its composition roughly includes two situations. The first is the emergency management system in a narrow sense, which mainly consists of "plan system, emergency system, emergency mechanism and legal system"; the second is a broad emergency management system, in addition to "plan system, emergency system, emergency mechanism and legal system" as the core, there are also personnel, technical equipment, information platform, security system, etc. The transportation emergency management work started in 2004[14][15]. Through the construction of "plan system, emergency system, emergency mechanism and legal system", the construction of facilities, equipment and teams has been promoted, and the transportation management ability has been comprehensively improved[16]. Combined with the actual situation of transportation emergency management, the transportation emergency management system refers to the sum of the relevant emergency elements and the relationship between the elements such as organization, system, behavior, and resources in response to transportation emergencies. , as well as personnel, technical equipment, information platform, security system, etc.

2.2 The situation faced by transportation emergency management

On November 29, 2019, President Xi Jinping pointed out in the 19th collective study of the Political Bureau of the CPC Central Committee that it is necessary to give full play to the characteristics and advantages of my country's emergency management system and learn from foreign emergency management. Actively promote the modernization of my country's emergency management system and capabilities. To promote the modernization of the transportation emergency management system and capabilities, it is necessary to clarify the current level of transportation emergency management[17]. After the 19th National Congress of the Communist Party of China, the reform of the national emergency management system, the relevant requirements of laws and regulations on the construction of the emergency management system and mechanism, the strategy of building a strong transportation country, and the construction of transportation emergency have pointed out the direction for the target function of the construction

of transportation emergency management evaluation indicators[18].

2.3 Function of index system of transportation emergency management

The index system is used to evaluate transportation emergency management, to clarify the vulnerability of emergency management, and to provide support for the improvement of emergency management capabilities. The index system can be used to determine whether it can effectively protect and save lives and property in response to transportation emergencies, and it can help the transportation industry find loopholes in the construction and development of the emergency management system, and assist the transportation authorities in real-time focus. regulation. The quality and level of emergency management can be improved by improving and optimizing the evaluation results of all aspects of emergency management. Therefore, indicators should have the functions of description, reflection, evaluation and guidance.

3. Construction of evaluation index system

3.1 Principles of index selection

- a. Comprehensiveness. The indicator system emergency covers all kinds of transportation emergencies, not only considering certain aspects of indicators, but also reflecting indicators as comprehensively as possible.
- b. Representative. Combined with the actual situation of emergency management in transportation, the emergency indicator system objectively reflects the actual conditions of emergency management.
- c. Operability. The data required for the indicator system is as easy to collect as possible.

3.2 Basis for selection of indicators

- a. Emergency management process. Early warning and prevention are carried out before the occurrence of transportation emergencies, and responses are started after the occurrence of the incident. The transportation emergency rescue process can be divided into the stages of prevention preparation, early warning and prediction, emergency response, emergency disposal, restoration and reconstruction, etc. Each stage can correspondingly extract relevant indicators. For example, in the emergency response stage, various measures should be taken to control the situation. Emergency personnel, equipment, etc. are needed.
- b. Elements of emergency management system. According to the connotation of the transportation emergency management system, the components of the transportation emergency management system include the emergency system, emergency mechanism, emergency legal system, emergency plan system, emergency team, emergency equipment, emergency platform, etc.

4. Structure of the indicator system

4.1 First-level indicators

There are seven first-level indicators in the transportation emergency management evaluation index system, including emergency management system, emergency management mechanism, emergency management legal system, emergency plan system, emergency management talent team, emergency equipment, and emergency information platform.

4.2 Secondary indicators

A. Emergency system. In terms of system, the contents of institutions, personnel and funds are mainly considered, and 4 secondary indicators are set: institutional setting, division of responsibilities, staffing, and special funding guarantee.

B. Emergency mechanism. Screening of key mechanisms involved in the transportation emergency process, setting up a ministry-province linkage mechanism, a joint meeting mechanism, a risk prevention mechanism, an emergency preparedness mechanism, a publicity, education and training mechanism, a social mobilization mechanism, an early warning and prevention mechanism, and an international cooperation mechanism, early disposal mechanism, rapid assessment mechanism, decision-making command mechanism, coordination and linkage mechanism, information sharing mechanism, restoration and reconstruction mechanism, investigation and evaluation mechanism, emergency action funding guarantee mechanism, expropriation compensation mechanism and other secondary indicators.

C. Emergency legal system. The emergency legal system mainly examines the promulgation and implementation of relevant regulations and documents issued by local governments, relevant units and institutions.

D. Emergency plan system. The emergency plan system is set up with two secondary indicators for the establishment and operation of the plan system.

E. Emergency talent team. From the perspective of building a multi-level emergency talent team, according to the source of the team, set up four secondary indicators of professional team, member unit team, social team, and expert team.

F. Emergency equipment. Select four secondary indicators of emergency equipment achievement capability, application of new technology and new equipment, equipment management and maintenance level, and equipment and facility construction funding guarantee.

G. Emergency information platform. Considering that the construction of emergency informatization platforms has started in various provinces, the indicators mainly examine the construction and operation of emergency informatization platforms, and set up two indicators of platform construction and platform operation.

4.3 Three-level indicators

A.1. Institutional setting mainly examines the establishment of emergency organizations, service and duty agencies, including the establishment of transportation emergency agencies at all levels, the establishment, levels and functions of service and duty agencies.

A.2. Responsibilities division Mainly examine whether the emergency responsibilities of each relevant transportation unit are clear.

A.3. Personnel establishment mainly examines the number of personnel establishments engaged in transportation emergency management work, and the situation of on-the-job personnel.

A.4. Fund security mainly examines the amount of special funds for transportation emergency, whether it is included in the financial budget of the same level, and the use of funds.

B.1. Ministry-province linkage mechanism mainly inspects the construction of the consultation platform, the communication and contact mechanism of transportation emergency management agencies at all levels, and the establishment of the working mechanism of liaison personnel at the executive level.

B.2. The joint meeting mechanism mainly examines the construction and operation of the joint meeting mechanism, the regular meeting mechanism, and the cooperation mechanism with other departments.

B.3. The risk prevention mechanism mainly examines the development of risk assessment work

before the preparation of the emergency plan.

B.4. Emergency Preparedness Mechanism It mainly examines whether to establish an emergency preparedness mechanism.

B.5. Publicity, education and training mechanism mainly examine whether to establish a publicity, education and training mechanism.

B.6. Social mobilization mechanism mainly examine whether to establish a social mobilization mechanism.

B.7. Early warning and prevention mechanisms mainly examine the early warning mechanisms and defense response mechanisms for typhoons, strong winter winds, floods, and severe weather.

B.8. International cooperation mechanism mainly examines whether to establish an international cooperation mechanism.

B.9. Early disposal mechanism It mainly examines whether to establish an early disposal mechanism.

B.10. Rapid evaluation mechanism mainly examine whether to establish a rapid evaluation mechanism.

B.11. Decision-making command mechanism mainly examines whether to establish a decision-making command mechanism.

B.12. Regional linkage mechanism mainly examines the establishment of linkage mechanism between adjacent or similar provinces and cities.

B.13. Information sharing mechanism mainly investigates the establishment of information reporting and sharing mechanisms with relevant units such as oceanography, meteorology, and environment.

B.14. Restoration and reconstruction mechanism mainly examine whether to establish a restoration and reconstruction mechanism.

B.15. Investigation and evaluation mechanism. It mainly examines whether to establish an investigation and evaluation mechanism.

B.16. The emergency action funding guarantee mechanism mainly examines whether to establish a special fund or fund that can support the expenses incurred by each emergency action.

B.17. Expropriation compensation mechanism mainly examine the establishment of the expropriation compensation system; the guarantee and management of the expropriation compensation funds; the working procedures and standards of the expropriation compensation, etc.

C.1. The formulation of laws and regulations related to emergency management mainly inspects the emergency legal system. The main inspection is to inspect the relevant laws and regulations and documents issued by local governments, relevant units and institutions, especially the promulgation of laws and regulations related to transportation emergency management.

C.2. The work specifications and implementation of emergency management mainly examine the specifications of on-duty duty, platform construction, emergency command, equipment allocation, team building, and handling of dangerous situations, as well as the implementation of the on-duty duty, information reporting and other systems issued by the Ministry.

D.1. The establishment of the plan system shall consider the completeness and operation of the plan system.

D.2. The operation of the plan system mainly inspects the implementation of the plan and emergency drills.

E.1. The professional team mainly inspects its training funding guarantee, treatment guarantee, and team stability.

E.2. The team of member units mainly inspects their receiving emergency training and education, participating in emergency drills, and emergency skills.

E.3. The social team mainly inspects the professional composition, training and skills of the

volunteer team.

E.4. The expert team mainly inspects whether the expert database is established and whether the major is comprehensive.

F.1. Emergency equipment reachability mainly examines the arrival time and coverage of emergency forces.

F.2. The application of new technologies and new equipment mainly examines artificial intelligence, a new generation of information technology and satellite communication systems, especially the “Internet + emergency” system, Bei Dou satellite navigation system, drones, unmanned boats, etc. in emergency response application situation.

F.3. Equipment management and maintenance level It mainly examines the management and maintenance funds, daily maintenance status, and use status of emergency equipment.

F.4. Funding guarantee for equipment and facility construction. The main consideration is whether the need for emergency equipment construction has been fully considered in the government construction funding arrangement.

G.1. Platform construction mainly examines whether there is an emergency informatization platform that can realize one or more functions such as dispatching and commanding, joint business, information exchange, and resource sharing.

G.2. Platform operation mainly examines the actual operation of the established system platform.

5. Evaluation and application of the indicator system

Table 1: Example of Evaluation Criteria Checklist

First-Level Indicators	Secondary Indicators	Scores
Emergency System	A.1.	20
	A.2.	20
	A.3.	30
	A.4.	30
Emergency Mechanism	B.1.	10
	B.2.	10
	B.3.	10
	B.4.	10
	B.5.	10
	B.6.	10
	B.7.	10
	B.8.	10
	B.9.	10
	B.10.	10
	B.11.	10
	B.12.	10
	B.13.	10
	B.14.	10
	B.15.	10
	B.16.	10
	B.17.	10
Emergency Legal System	C.1.	50
	C.2.	50
Emergency Plan System	D.1.	20
	D.2.	25
	D.3.	25
	D.4.	30
Emergency Talent Team	E.1.	30
	E.2.	20
	E.3.	30
	E.4.	20
Emergency Equipment (Capacity)	F.1.	20
	F.2.	20
	F.3.	20
	F.4.	20
Emergency Information Platform	G.1.	20
	G.2.	20

Combining the elements of the emergency management system and the emergency procedures, and classifying them, the first-level indicators of the seven transportation emergency management evaluation index systems are formed, including the emergency management system, emergency management mechanism, emergency management legal system, emergency plan system, and emergency management personnel. Team, emergency equipment, emergency information platform.

Combined with the actual situation of transportation emergency management work, taking into account the characteristics of the industry, research and put forward operability standards to provide a basis for the evaluation results. According to the previous practice of transportation safety emergency inspection, the specific score distribution of this evaluation method is shown in Table 1. Finally, according to the weighted average of the scores of all experts in the expert group, the overall transportation emergency management work of the evaluated project is obtained.

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6. Conclusion

In this paper, combined with the components of the transportation emergency management system and the emergency process, a transportation emergency management evaluation index system is established, which includes 7 first-level indicators, 35 second-level indicators. The indicator system needs to be closely integrated with the actual transportation emergency in order to ensure scientificity and practicability, and it needs to be continuously used to be more perfect. In the future research and work, we will continue to use it, accumulate experience, and update and improve the transportation emergency management index system.

According to the actual situation of transportation emergency management, combined with the emergency management theory, carry out the research on the transportation emergency management index system, put forward a comprehensive transportation emergency management index system, determine the emergency management index evaluation method, and provide support for the construction of the transportation emergency management system.

The evaluation index system of transportation emergency management must be closely integrated with the actual situation of transportation emergency in order to ensure scientificity and practicability, and the index system needs to be practically used to be more perfect. However, since the current index system is not widely used, there is still room for further improvement in the rationality and operability of index setting and evaluation criteria. In future research and work, the indicator system of transportation emergency management will be updated and improved in combination with the development of transportation emergency management and the application practice of the indicator system.

Acknowledgment

This paper is funded by the China Central Public Interest Scientific Institution Basal Research Fund (20190508).

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