

Research on Ro-Ro Ship Safety Transportation Model

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Abstract. This paper makes a thorough study and comparison of the characteristics of the Ro-Ro passenger ship and the related safety evaluation methods. In the analysis of the safety factors of the passenger rolling ship, the relevant elements of the rolling ship accident are determined by carrying on the real ship investigation, the expert investigation and the related literature analysis, and the safety evaluation index system of the passenger Ro-Ro passenger ship is constructed. The weight of Ro-Ro passenger ship safety evaluation index is obtained by AHP.

Introduction

With the development of economic globalization and the rise of new technological revolution, the shipping industry has also been developing and prospering with the gradual improvement of the status of the ocean. The technical content of the Ro-Ro passenger ship is self-evident in the shipping field, and is considered to be the top priority of the shipping industry with the LNG LPG ship. The Ro-Ro passenger ship has many advantages, such as high efficiency, convenient and low energy consumption. These characteristics have laid the irreplaceable shipping status of the rolling boat, which is highly recognized by the ship companies and the shippers.

This paper makes a thorough study and comparison of the characteristics of the Ro-Ro passenger ship and the related safety evaluation methods, and puts forward the method of the evaluation of the extension in the safety evaluation of the rolling ship. In the analysis of the safety factors of the Ro-Ro passenger ship, the Ro-Ro passenger ship is investigated, the expert investigation and the related literature analysis are carried out to analyze and determine the occurrence of the Ro-Ro passenger ship. The relevant factors of the accident are constructed, and the safety evaluation index system of the passenger rolling ship is constructed, and the weight of the safety evaluation index of the passenger ship is determined by the analysis and study of the commonly used analytic hierarchy process (AHP) in the acquisition of the weight of the safety evaluation index of the passenger ship.

Analytic Hierarchy Process

AHP method decomposes complex systems into small factors. The hierarchical structure of each mechanism can make single layer or multi-layer. In determining the relative importance of each factor in the hierarchy (or weight), the relative importance of the factors is finally determined by combining the human judgment through the 22 comparison. Generally speaking, there are four steps in the AHP method: (1) the decomposition of the system and the establishment of a hierarchical structure; (2) the 22 comparison matrix is constructed according to the hierarchy structure and the relationship; (3) the relative weight of the comparison elements is calculated; (4) the calculation of the weight of the elements of each layer is used to calculate the weight of the elements. The main characteristics of the analytic hierarchy process are: the analytic hierarchy process is simple and clear, and it is suitable for the system evaluation of multi objective and multiple criteria, and the analytic hierarchy process is very suitable for the study of objects with uncertainty and subjective information. And it can make the subjective factors such as experience and intuition more logical and reasonable.

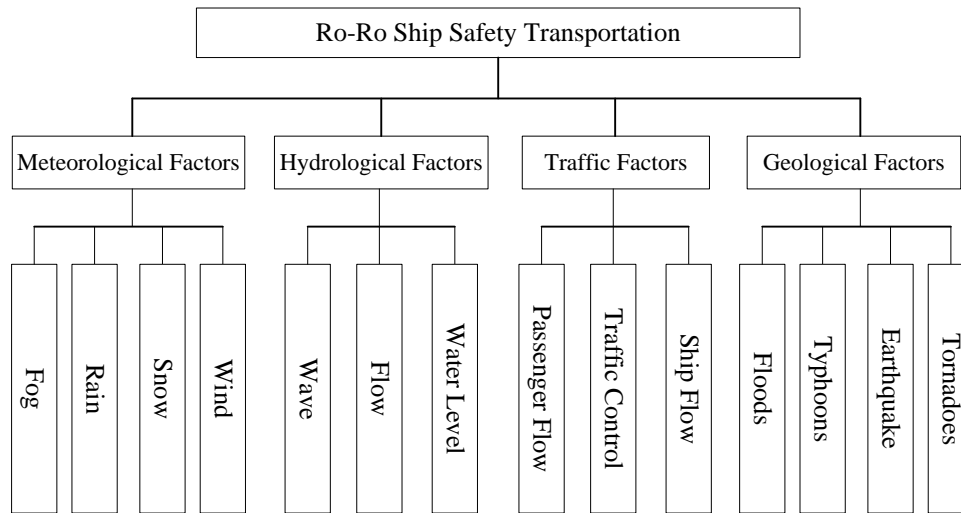


Figure 1. Ro-Ro Ship Safety Transportation

Setup Judgment Matrices

The hierarchical structure of this paper is based on the evaluation index system of Ro-Ro Ship Safety Transportation established above, and test the consistency, and weigh the value of each index layer as follow:

A0

$$\begin{bmatrix} 1 & 2 & 3 & 5 \\ 1/2 & 1 & 2 & 3 \\ 1/3 & 1/2 & 1 & 2 \\ 1/5 & 1/3 & 1/2 & 1 \end{bmatrix}$$

The contrast matrix A0 passes the consistency test, and each vector weight vector W is:

$$W = (0.4824, 0.2718, 0.1575, 0.0883)$$

$$\lambda_{\max} = 4.0145, \quad CI = 0.0048, \quad CR = 0.0054 < 0.1$$

A1

$$\begin{bmatrix} 1 & 5 & 3 & 2 \\ 1/5 & 1 & 1/2 & 1/3 \\ 1/3 & 2 & 1 & 1/3 \\ 1/2 & 3 & 3 & 1 \end{bmatrix}$$

The contrast matrix A1 passes the consistency test, and each vector weight vector W is:

$$W = (0.4730, 0.0867, 0.1425, 0.2978)$$

$$\lambda_{\max} = 4.0651, \quad CI = 0.0217, \quad CR = 0.0241 < 0.1$$

A2

$$\begin{bmatrix} 1 & 2 & 4 \\ 1/2 & 1 & 3 \\ 1/4 & 1/3 & 1 \end{bmatrix}$$

The contrast matrix A2 passes the consistency test, and each vector weight vector W is:

$$W = (0.5571, 0.3202, 0.1226)$$

$$\lambda_{\max} = 3.0183, \quad CI = 0.0092, \quad CR = 0.0155 < 0.1$$

A3

$$\begin{bmatrix} 1 & 5 & 3 \\ 1/5 & 1 & 1/3 \\ 1/3 & 3 & 1 \end{bmatrix}$$

The contrast matrix A3 passes the consistency test, and each vector weight vector W is:
 $W = (0.6333, 0.1062, 0.2605)$

$$\lambda_{\max} = 3.0387, \quad CI = 0.0194, \quad CR = 0.0328 < 0.1$$

A4

$$\begin{bmatrix} 1 & 2 & 3 & 5 \\ 1/2 & 1 & 3 & 5 \\ 1/3 & 1/3 & 1 & 3 \\ 1/5 & 1/5 & 1/3 & 1 \end{bmatrix}$$

The contrast matrix A4 passes the consistency test, and each vector weight vector W is:
 $W = (0.4560, 0.3238, 0.1522, 0.0680)$

$$\lambda_{\max} = 4.1048, \quad CI = 0.0349, \quad CR = 0.0388 < 0.1$$

From the above analyze, we can get the weight of each indicator.

Conclusion

This paper makes a thorough study and comparison of the characteristics of the rolling ship and the related safety evaluation methods, and puts forward the method of the evaluation of the extension in the safety evaluation of the rolling ship. In the analysis of the safety factors of the rolling ship, the rolling ship is investigated, the expert investigation and the related literature analysis are carried out to analyze and determine the occurrence of the rolling ship. The relevant factors of the accident are constructed, and the safety evaluation index system of the passenger rolling ship is constructed, and the weight of the safety evaluation index of the passenger ship is determined by the analysis and study of the commonly used analytic hierarchy process (AHP) in the acquisition of the weight of the safety evaluation index of the passenger ship.

References

- [1] Frederic P, Philipp K, Roger S. Experience Co-creation in Financial Services:An Empirical Exploration. *Journal of Service Management*, 2015, 26 (2), pp.295-320.
- [2] Yu Huixian. Recruitment Based on Competency Model[J].*Chinese and Foreign Exchanges*, 2017,(17): 30
- [3] Assante M, Candela L, Castelli D. Are Scientific Data Repositories Coping with Research Data Publishing. *Data Science Journal*, 2016(15), pp.1-24.
- [4] Dnyandeo Dattatraya Shinde, Ramjee Prasad. Application of AHP for Ranking of Total Productive Maintenance Pillars. *Wireless Personal Communications*, 2018, 100 (2), pp.449-462.
- [5] Saeid Maknoui, Mohammad Zare, Ezzatollah Raeisi. Determining the hard rock groundwater pathway in Golgohar complex formation using hydrochemical data in AHP. *Arabian Journal of Geosciences*, 2018, 11 (8), pp.1-16.
- [6] Arthur S. Levine, Margaret C. McDonald, Charles E. Bogosta. Sino-U.S. partnerships in research, education, and patient care: The experience of the University of Pittsburgh and UPMC. *Science China Life Sciences*, 2017, 60 (10), pp.1150-1156.