Research on the Index System of Ship Safety Evaluation during the Storm

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Abstract. In order to improve the safety of the ship in the storm, this paper analyzes the impact of the storm weather on the ship's safety, and puts forward the response measures for the ship to sail in the gale wave, in order to help the ship in the storm safe navigation.

Introduction

During the storm, the ships are caused by the combined effects of wave force and wind force, and the ships sailing in it are shaken and rocking seriously. When the inclination angle of the ship is greater than the angle of the deck immersion, the deck of the ship will rise. Due to the increase in vertical swing and longitudinal shaking during sailing in large storms, the ship's spiral rotor will frequently expose the water surface, and the depth ratio of the propeller will be greatly reduced, resulting in a decrease in fluid resistance around the propeller, an increase in speed, and vibration. The so-called speed phenomenon. The ship's resistance will increase greatly in the storm, and the propeller's speed effect will lead to a significant reduction in the speed of the ship compared to the speed of the static water. Under a certain state of power, the more serious the speed reduction, the greater the load of the host. In order to protect the ship's host, the ship has to reduce the engine speed, thus increasing the overall transportation costs. The freedom of movement of the ship in the storm is greatly accelerated. When the acceleration of the movement exceeds the range that the ear cavity can withstand in the person's body, seasickness will occur. Under seasickness, the crew's behavioral ability will be greatly reduced and the body function will be reduced.. It affects the normal operation of the work.

No matter which sea area the ship is sailing in, the conditions for navigation can not be avoided. The navigation conditions of the storm waves are a great threat to the navigation safety of ships.

Analytic Hierarchy Process

Analytic hierarchy process is an analytical method combining qualitative analysis with quantitative analysis. The principle is to decompose complex problems into several levels and factors, make comparative judgment on the importance of the two indicators and establish judgment matrix. Through calculation of the judgment matrix eigenvalues and corresponding eigenvectors, the largest the degree of importance weights to different schemes are obtained and provide important basis for the selection of optimal:
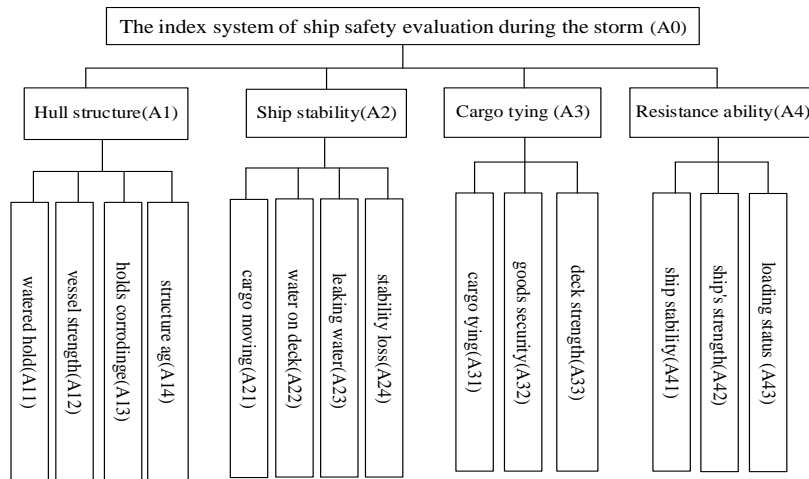
Figure 1. Index System of Ship Safety Evaluation

Construct the Judgment Matrix

Construct the judgment matrix and list x influencing factors respectively, forming an x-order A=(x). ,)... Each factor is compared in importance by a binary combination. X - order matrix each row matrix port; denotes the degree of importance of one factor to the rest of each factor; Similarly, for each column of moments, i represents the degree to which other factors are relevant to the same factor. According to the judgment matrix criterion, the relative importance and degree of importance of any two factors under the same criterion are compared by referring to the expert consultation and theoretical derivation, and according to the actual situation of the project, the importance degree of influencing factors is determined by assigning the number 1-9 logical relation according to the degree of importance.

A0	A1	A2	A3	A4
A1	1.0000	0.3333	0.2500	0.2500
A2	3.0000	1.0000	0.5000	1.0000
A3	4.0000	2.0000	1.0000	2.0000
A4	4.0000	1.0000	0.5000	1.0000

The result of calculation is as follow:

CI=0.0153   CR=0.0170

The contrast matrix A4 passes the consistency test, and each vector weight vector W is:

W = (**0.0818   0.2346   0.4288   0.2548**) $\lambda_{\max} =$ **4.0458**

A1	A11	A12	A13	A14
A11	1.0000	2.0000	2.0000	0.5000
A12	0.5000	1.0000	0.5000	0.5000
A13	0.5000	2.0000	1.0000	1.0000
A14	2.0000	2.0000	1.0000	1.0000

The result of calculation is as follow:

CI=0.0618   CR=0.0687

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

W = (**0.2873   0.1357   0.2370   0.3400**) $\lambda_{max} =$ **4.1855**

A2	A21	A22	A23	A24
A21	1.0000	0.3333	0.5000	3.0000
A22	3.0000	1.0000	0.5000	2.0000
A23	2.0000	0.2000	1.0000	1.0000
A24	0.3333	0.5000	1.0000	1.0000

The result of calculation is as follow:

CI=0.0234   CR=0.0260

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

W = (**0.2356   0.3728   0.2303   0.1613**) $\lambda_{max} =$ **4.0701**

A3	A31	A32	A33
A31	1.0000	3.0000	2.0000
A32	0.3333	1.0000	1.0000
A33	0.5000	1.0000	1.0000

The result of calculation is as follow:

CI= 0.0091   CR= 0.0157

The contrast matrix A3 passes the consistency test, and each vector weight vector W is:

W = (**0.5499   0.2098   0.2402**) $\lambda_{max} =$ **3.0183**

A4	A41	A42	A43
A41	1.0000	4.0000	2.0000
A42	0.2500	1.0000	1.0000
A43	0.5000	1.0000	1.0000

The result of calculation is as follow:

CI=0.0268   CR=0.0462

The contrast matrix A3 passes the consistency test, and each vector weight vector W is:

W = (0.5842   0.1840   0.2318) $\lambda_{max} =$ 3.0536

There are 4 first class indicators including hull structure, ship stability:, cargo tying, resistance ability, ship stability is more important. Among hull structure, vessel strength is more important. Among ship stability, stability loss is important. Among cargo tying, goods security is a little important. Among resistance ability, ship stability is important.

Conclusion

When a ship is sailing in a big storm, it will experience waves on the deck, attacks, reduced propulsion efficiency, and severe shaking. In order to improve the safety of ships in stormy weather, The ship must make adequate preparations before entering the storm zone. After entering the storm

zone, it must choose a reasonable method of sailing. After leaving the storm zone, it must promptly inspect the ship's condition and make a total conclusion.

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