

SECTION 13.

TRANSPORTS ET TECHNOLOGIES DE TRANSPORT

DOI 10.36074/logos-20.09.2024.030

DEVELOPMENT OF A RISK ASSESSMENT ALGORITHM TO IMPROVE SAFETY OF SHIP MOORING OPERATIONS

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Introduction. Mooring operations represent one of the most critical aspects of maritime transportation operations where accuracy and safety are paramount. These operations are essential to ensure the safe berthing and departure of vessels from berths in ports and roadsteads. Errors during mooring operations can lead to serious accidents, resulting not only in material losses but also endangering the lives of the crew and the surrounding marine environment. The importance of such operations is confirmed by centuries of maritime history and continuous efforts to improve technologies and techniques to minimize risks.

Problem Statement. Existing risk assessment methodologies for mooring operations are often inadequate or outdated due to rapidly changing marine

environmental conditions and increasing safety requirements for maritime operations. Many of the traditional risk assessment approaches are based on experience and intuition, which can lead to subjective interpretation and potential errors. In addition, the lack of attention to comprehensive assessment of influencing factors such as meteorological conditions, technical condition of equipment and psycho-physiological state of the crew increases the likelihood of unwanted incidents.

With the constant development of marine technology and changes in international safety standards, it is necessary to continuously develop and implement an improved risk assessment system that takes into account all aspects and is adapted to the current conditions of maritime activities. This system should be based on objective data and advanced analytical methods to facilitate rational decision-making and improve the safety of mooring operations.

Goals and Objectives. Develop and implement an improved risk assessment system for mooring operations that will incorporate current safety requirements, objective data, and effective analytical methods to minimize risks.

Advanced Flowchart for Mooring Operation Risk Assessment

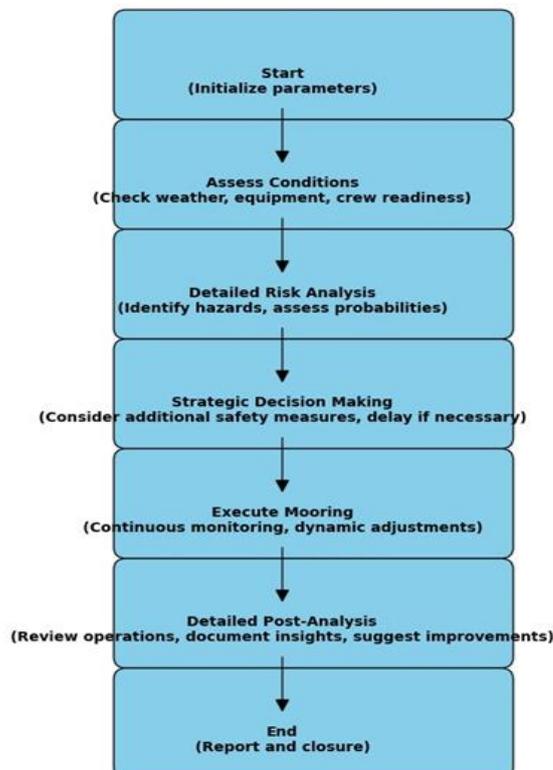


Fig. 1. Algorithm of risk assessment for mooring operations performance



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Core Material. To solve the set tasks, the paper proposes a risk assessment algorithm for mooring operations, which aims to improve the safety and efficiency of maritime operations. Thus, the assessment of initial conditions is the first and one of the most important stages of the proposed algorithm. This stage includes collecting and analyzing data on weather conditions (wind, tides, and precipitation), condition of the vessel and mooring equipment, and crew readiness to perform operations. In addition, the use of modern technologies such as sensors and weather forecasting systems provides objective data for an accurate risk assessment prior to mooring.

The risk analysis in the proposed algorithm includes a detailed assessment of possible threats, based on collected data. The following aspects can also be considered:

Meteorological conditions such as the influence of wind, waves and currents on the ship's maneuvering and mooring safety;

The technical condition of the vessel and equipment, namely assessment of the correctness of mooring ropes, cranes and other elements that may affect the mooring process;

Human factor where the assessment of the crew's level of fatigue, their preparation and ability to respond to changing conditions is taken into account.

These data are processed using probabilistic risk analysis methods to determine the levels of threat and possible impact on the operation.

Based on the risk analysis, the algorithm proposes several options for action, such as:

- Continuing the mooring at an acceptable level of risk;
- Applying additional safety measures (e.g. using tugs or additional mooring ropes);
- Postponing the operation in case of unfavorable conditions.

This approach allows ship management and company operators (ship owner) to make decisions based on objective data, minimizing subjective errors and improving the overall safety of the operation. Post-analysis plays a key role in improving mooring operations. After the mooring is completed, a detailed analysis of all aspects of the operation is performed: how the measures taken were implemented, what incidents or problems occurred, and what factors influenced the success or difficulties in the process. This stage helps to identify bottlenecks in the algorithm and make adjustments for future operations. Also, post-analysis allows you to accumulate data for further training of the algorithm, which increases its accuracy and adaptability to different conditions.

Conclusion. The proposed algorithm integrates modern methods of data

collection and analysis, allowing an objective risk assessment based on meteorological, technical and human factors. It incorporates a detailed risk analysis process and strategic decision-making, which helps to reduce the probability of incidents. With post-analysis, the algorithm is highly adaptable to changing conditions and is capable of continuous improvement. It can be effectively applied to different types of ships and under a variety of mooring conditions. Implementation of the proposed risk assessment system and its introduction into the practice of mooring operations contribute not only to the reduction of accidents, but also to the improvement of the overall efficiency of the crew and vessels. This solution can become a standard for maritime companies seeking to improve the quality of their operations.

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