The Role of Education in Enhancing Ramp Door Maintenance Management to Minimise Accidents in the Loading and Unloading Sector

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Abstract. This study aims to analyse the operating procedures and maintenance of ramp doors on Ro-Ro vessels to avoid the risk of accidents during the loading and unloading process. Ro-Ro vessels facilitate the loading of vehicles such as cars and heavy equipment through ramp doors, which are ramp doors that allow vehicles to enter and exit the vessel. This research was conducted during on KMP Dharma Rucitra I owned by PT Dharma Lautan Utama. The method used is descriptive qualitative with data collection techniques through interviews, observation, and documentation. The results showed that ramp door maintenance was carried out on a limited basis due to the difficulties and dangers associated with ships in operation. The ramp door operating procedures should take into account factors such as weather conditions, sea currents, and routine maintenance to prevent accidents. This study recommends the need for more routine maintenance procedures and training for ship crews in ramp door operations to reduce the risk of accidents.

Keywords: Ro-Ro vessel, ramp door, vessel maintenance, operating procedures, vessel accident.

1. INTRODUCTION

The loading and unloading process is a crucial stage in the supply chain, where efficiency and safety play vital roles. In logistics and transportation industries, loading and unloading activities are among the most frequently performed tasks and require special attention. One of the essential components in this process is the ramp door, which serves as a bridge between transport vehicles and storage or loading areas. Given this critical function, ramp doors can significantly affect operational fluidity and the safety of workers involved in the loading and unloading processes.

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However, many companies face challenges regarding the maintenance of ramp doors. Inadequate maintenance can lead to malfunctions, which, in turn, can increase the risk of accidents. According to a report from the *Occupational Safety and Health Administration (OSHA)*, accidents involving ramp doors are often caused by factors such as mechanical failures, improper usage, and a lack of operator training (OSHA, 2019). Therefore, implementing effective maintenance management is essential to prevent accidents from occurring.

Previous studies have also shown that companies implementing preventive maintenance systems for ramp doors experience a significant reduction in workplace accidents. In this context, preventive maintenance refers to a series of scheduled actions aimed at preventing damage or failure before they occur. Research conducted by Wibowo (2021) indicates that preventive maintenance systems not only enhance the lifespan of equipment but also contribute to overall workplace safety. In other words, investing in good maintenance practices provides long-term benefits for companies, both financially and in terms of reputation.

Furthermore, the importance of training for operators cannot be overlooked. Well-trained operators are more likely to understand how to use ramp doors safely and efficiently. Training should encompass a deep understanding of safety procedures, how to detect malfunctions, and the correct operational techniques. In a study published in the *Journal of Occupational Safety and Health*, Andriani (2021) stated that organizations investing time and resources in training their employees can significantly reduce workplace accident rates.

In the maritime context, the presence of ramp doors on passenger ships and Roll-On/Roll-Off (RORO) vessels also becomes a primary concern. Ramp doors on ships must be designed and maintained properly to ensure the safety of passengers and cargo during boarding and disembarkation processes. Research by Smith et al. (2022) highlights that negligence in the maintenance of ramp doors on ships can have fatal consequences, leading to serious injuries to passengers and financial losses for companies. Therefore, emphasizing ramp door maintenance management should be a priority, not only on land but also at sea.

Considering the complexity and significance of the aspects related to ramp door maintenance, this article aims to explore best practices in ramp door maintenance management. Using a qualitative approach, this study will identify the steps companies can take to enhance safety and efficiency in the loading and unloading processes. This research is expected to provide better insights for companies in managing and maintaining ramp doors, thereby reducing accident risks and improving overall performance in their operational processes.

Figure 1.*Ramp door* MV Watunapato broken
Source : manado.tribunnews.com

2. METHODOLOGY

This study adopts a qualitative research methodology to gain an in-depth understanding of ramp door maintenance management practices within the loading and unloading processes. Qualitative research is particularly effective for exploring complex phenomena, as it captures the nuances of human experiences, perceptions, and interactions. The primary objective of this research is to gather comprehensive insights from various stakeholders involved in the maintenance and operation of ramp doors, enabling a thorough analysis of existing practices and their impact on safety and efficiency.

Data collection was conducted through semi-structured interviews with a diverse group of participants, including operational managers, maintenance technicians, and frontline workers engaged in loading and unloading activities across several logistics and maritime companies. The semi-structured format of the interviews allowed for flexibility, enabling participants to share their experiences and opinions in their own words while also ensuring that key topics related to ramp door maintenance were covered. The interviews were designed to elicit rich, descriptive data regarding the participants' experiences with ramp door operations, the challenges they face, and their perceptions of current maintenance practices and safety protocols.

To enhance the validity of the findings, direct observations of the ramp door maintenance procedures and loading operations were conducted at various sites. This observational component provided valuable context and allowed the researchers to witness firsthand the practical application of maintenance practices and safety measures in real-time. By triangulating data from interviews and observations, the study aimed to achieve a more comprehensive understanding of the practices and challenges associated with ramp door maintenance.

The data collected from the interviews and observations were analyzed using thematic analysis, a widely used qualitative analysis method that identifies and interprets patterns and themes within qualitative data. The thematic analysis process involved several stages, including familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and finally,

producing the report. This systematic approach enabled the researchers to distill the participants' responses into meaningful themes that reflect the prevailing practices, challenges, and suggestions for improvement in ramp door maintenance management.

By utilizing a qualitative approach, this study not only highlights the best practices in ramp door maintenance but also uncovers the underlying factors contributing to safety issues during loading and unloading processes. The findings from this research are anticipated to inform best practices and develop recommendations for enhancing safety measures, ultimately contributing to improved operational performance and reduced accident risks in the industry.

3. RESULT AND DISCUSSION

The research identified critical themes regarding ramp door maintenance management practices specifically for RORO (Roll-On/Roll-Off) and passenger vessels. The following table summarizes the current best practices, challenges, and recommendations derived from the analysis, reflecting the operational realities of these types of vessels.

Table 1. summarizes reflecting the operational realities of these types of vessels

Key Themes	Best Practices	Challenges	Recommendations
Routine Preventive Maintenance	- Implementation of scheduled maintenance checks on ramp doors. - Use of checklists during inspections to ensure thorough evaluations.	- Limited dry-docking periods, restricting maintenance opportunities. - Budget constraints limiting maintenance frequency.	- Develop a maintenance schedule that optimizes dry-docking time. - Seek partnerships for funding maintenance activities.
Operator Training	- Continuous training programs focusing on ramp door operations and emergency procedures. - Simulation-based training for handling emergencies.	- High turnover rates among crew members, affecting training continuity. - Inconsistent training quality across different crews.	- Standardize training protocols across all vessels. - Utilize e-learning platforms for training accessibility.
Safety Procedures	- Strict enforcement of safety protocols during loading and unloading operations. - Routine drills for emergency evacuations and ramp door operations.	- Complacency among crew members regarding safety practices. - Language barriers impacting communication of safety procedures.	- Implement mandatory safety refresher courses. - Use visual aids and multilingual materials to improve communication.
Use of Technology	- Integration of automated systems for ramp door operation and monitoring. - Utilization of real-time data analytics for maintenance alerts.	- High initial investment costs for technology upgrades. - Resistance from crew in adopting new systems.	- Explore grants or funding opportunities for technology implementation. - Provide training

Key Themes	Best Practices	Challenges	Recommendations
			sessions focused on the benefits of technology.
Collaboration and Communication	- Establishing strong communication channels between crew members and maintenance teams. - Regular debriefing sessions post-operations to discuss challenges and solutions.	- Siloed departments leading to a lack of information sharing. - Limited time for discussions due to operational pressures.	- Create a culture of openness through regular cross-functional meetings. - Utilize digital communication tools for quick issue reporting.

The findings indicate that effective ramp door maintenance management is essential for ensuring safety and operational efficiency on RORO and passenger vessels. These ships are particularly vulnerable to risks during loading and unloading due to the high volume of passengers and vehicles involved, necessitating strict adherence to maintenance and safety protocols.

Best practices such as routine preventive maintenance and comprehensive operator training are vital in addressing the unique challenges faced by these vessels. For instance, the limited dry-docking periods present a significant challenge, requiring innovative scheduling and resource allocation to ensure that maintenance is conducted without disrupting operations.

The high turnover rates among crew members highlight the need for standardized training protocols and accessible learning platforms. Continuous training can help ensure that all crew members are equipped with the necessary skills and knowledge to operate ramp doors safely.

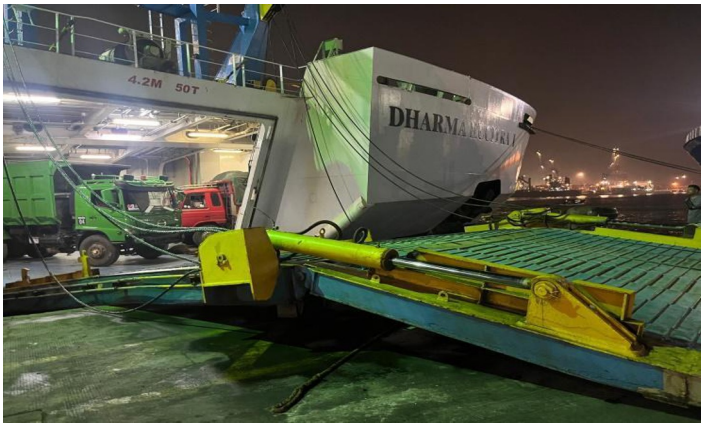

Figure 2. Condition of ramp door is too steep
Source: Author's Documentation

Moreover, the integration of technology can enhance operational safety and maintenance efficiency. Automated systems and real-time monitoring can significantly reduce the risk of accidents related to ramp door operations. However, organizations must also address the initial costs and crew resistance to adopting new technologies.

Figure 3. Pulling the bearing
Source: Author's Documentation

Finally, fostering collaboration and communication among crew members and maintenance teams can lead to a more responsive and agile operational environment. Regular debriefing sessions and cross-functional meetings can help create a culture of safety, where all team members feel empowered to report issues and share solutions.

Overall, by addressing the identified challenges and implementing the recommendations, RORO and passenger vessel operators can significantly enhance their ramp door maintenance management, ultimately leading to improved safety and operational performance.

4. Conclusion and Recommendations

In conclusion, effective ramp door maintenance management is critical in ensuring safety and operational efficiency in RORO and passenger vessels. The findings from this study highlight the importance of implementing routine preventive maintenance, comprehensive operator training, strict adherence to safety procedures, and the integration of technology. Given the unique challenges faced by the maritime industry, particularly the limited dry-docking periods and high turnover rates among crew members, it is essential for companies to adopt innovative strategies that address these issues.

The study also identified a pressing need for enhanced communication and collaboration among crew members and maintenance teams. By fostering a culture of openness and regular information sharing, organizations can create a safer operational environment that is responsive to emerging challenges. According to a study by *Smith et al. (2022)*, establishing clear communication channels significantly reduces the likelihood of accidents during loading and unloading operations.

Recommendations:

1. Enhance Preventive Maintenance Practices: Companies should develop and adhere to a comprehensive maintenance schedule that optimizes dry-docking periods and allocates sufficient resources for routine checks of ramp doors. As suggested by *Wibowo (2021)*, allocating budget for preventive maintenance not only extends the life of equipment but also enhances safety.

2. Standardize Operator Training: It is vital to implement standardized training protocols for all crew members, focusing on ramp door operations, emergency procedures, and safety protocols. Utilizing e-learning platforms can provide accessible training options, ensuring that all crew members receive consistent education.
3. Integrate Technology: Embracing technological advancements, such as automated ramp door systems and real-time monitoring, can significantly enhance maintenance efficiency and operational safety. Companies should explore funding opportunities to mitigate initial investment costs, as highlighted by *Hidayat & Kusuma (2019)*, who emphasized the role of technology in reducing human error.
4. Foster a Safety Culture: Regular safety drills and refresher courses should be mandatory to ensure that all personnel are familiar with safety protocols and emergency procedures. Encouraging crew members to participate in safety discussions and providing multilingual materials can help address language barriers and increase awareness.
5. Encourage Collaboration and Communication: Establishing regular cross-departmental meetings and utilizing digital communication tools can enhance collaboration among teams. Creating a platform for quick reporting of maintenance issues can improve response times and mitigate risks.

By implementing these recommendations, RORO and passenger vessel operators can improve ramp door maintenance management, thereby reducing accident risks and enhancing overall operational performance. The maritime industry must remain proactive in addressing these challenges to ensure the safety of passengers and crew members alike.

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