SAFETY ASSESSMENT FRAMEWORK OF TRAFFIC SEPARATION SCHEME AS COLLISION RISK CONTROL OPTION-PRACTICAL EXAMPLE OF SUNDA STRAIT IN INDONESIA-

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論 文 名：　SAFETY ASSESSMENT FRAMEWORK OF TRAFFIC SEPARATION SCHEME AS COLLISION RISK CONTROL OPTION -PRACTICAL EXAMPLE OF SUNDA STRAIT IN INDONESIA-
（分離通航方式による衝突リスク軽減策の安全性評価のフレームワークに関する研究　ーインドネシアのスンダ海峡への適用例ー　）

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論　文　内　容　の　要　旨

This paper presents a framework of doing a safety assessment in the case of vessel collision in the newly implemented traffic separation scheme (TSS) in Sunda Strait, Indonesia.

The maritime safety and security have become a concern to the International Maritime Organization (IMO) as the special agency of the United Nations. This organization is responsible to ensure the safety and security of the world's shipping. The good geographical position of Indonesia comes with not only big advantages, but also some challenges. Indonesia as the largest archipelagic state has obligations to provide free passages for the international route that is later named as the Indonesia Archipelagic Sea Lanes (IASL) as stated by the United Nations Convention on the Law of the Sea (UNCLOS) 1982. Due to many vessels are passing the IASL, Indonesia feels the urgency to set the TSS in its water to protect the safety of navigation. As a result, two traffic separation schemes: Sunda Strait and Lombok Strait were proposed to the IMO and approved in the 6th session of NCSR in January 2019 and then adopted by the MSC on its 109th session in June at the same year.

The implementation of TSS in Sunda Strait has an objective to reduce the number of head-on collisions by separating the opposing traffic. TSS Sunda Strait is also followed by other routeing measures such as a precautionary area and several inshore traffic zones. The number of TSS together with other measures are expected to grow in the near future as the world now is doing research for an autonomous vessel and the TSS is expected to help the autonomous vessel to navigate in a restricted water. However, another problem is emerged in the TSS Sunda Strait related to crossing situations that occurred due to a heavy traffic nearby the precautionary area as well as in the eastern side of Sunda Strait. Therefore, a reduction of the risk of crossing collision is also aimed.

To support the study, a safety assessment is carried out to evaluate the effectivity of the TSS Sunda Strait. This method is recommended by IMO to evaluate an existing policy or if a new policy is about to be made. The safety assessment consists of five steps that include: 1) hazard identification, 2) risk assessment, 3) risk control options, 4) cost benefit assessment, and 5) recommendation for decision maker.

Another important aspect in this study is data, as in the maritime sector the data is often scarce and not readily available. Automatic identification system (AIS) is a broadcasting system that can transmit information about the vessel including static and dynamic data autonomously.

This study is supported by the AISITS as the AIS data provider. The data collection process was conducted twice. The first one is from October 8th, 2018, until October 21st, 2019, representing the time before setting the TSS. The second one represents a period when the TSS is already implemented on April 6th, 2021, until July 24th, 2021. However, in that time interval there are some dates with data gap, which means no data received. This data gap is omitted from the analysis during the data processing step.

This thesis consists of six chapters and the contents are outlined as follows:

Chapter 1 outlines a brief introduction of the background, which is the overview of the vessels' traffic and the world concern about maritime safety. This chapter also describes the research motivation, objectives, and contributions given by this research in the form of publication papers.

Chapter 2 describes the state of the art of safety assessment, especially those related to the vessel collision. Ship domain and closest point of approach are explained as the basic consideration for doing safety assessment. Furthermore, a methodology utilised for this dissertation is introduced in this chapter.

Chapter 3 provides a comprehensive discussion about the hazard identification. A severe traffic condition in Sunda Strait is displayed as a density plot from extracting the AIS data by using IWRAP as a tool to be a vessel trip. A concept of vessel trips database is introduced to keep the record of vessel trips. A distance to closest point of approach (DCPA) was applied to determine the near-miss situations which the result was saved in a near-miss situation database.

Following that, Chapter 4 explains about the risk assessment process. Probabilistic risk assessment was carried out using time-based analysis with three point-of-views: crossing zone, course, and vessel type. Following that, a root cause analysis is conducted using bow tie analysis to capture the relation between causes and consequence and added with description of safety barriers that can prevent the consequence to happen.

Chapter 5 is started with a brief description of ships' routeing measures and examples of TSS in the world. The properties of TSS Sunda Strait are also explained in detail. Due to TSS is proposed as a risk control option in Sunda Strait, its effectivity must be assessed by redoing the risk assessment. The total annual frequency of crossing situation after the implementation of TSS showed a decrease compared to before implementing of TSS, which lead to a conclusion about the effectivity of TSS. Cost benefit ratio is used to assess the effectivity of TSS in terms of the cost and the establishment of aids to navigation considered to be cost effective for Crossing Zones 1,2, and 3. As the last step of safety assessment framework, recommendations for decision maker were outlined to support the implementation of RCOs.

Finally, Chapter 6 presents the research findings and recommendations for further research.