International Journal of Technology (2015) 6: 990-997
ISSN 2086-9614

IMPLEMENTATION OF TRAFFIC SEPARATION SCHEME FOR PREVENTING ACCIDENTS ON THE SUNDA STRAIT

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(Received: June 2015 / Revised: September 2015 / Accepted: September 2015)

ABSTRACT

The study is aimed at proposing a solution for preventing ship accidents, ship collisions in particular, in Indonesia's busiest ferry crossing lane between Merak on Java Island and Bakauheni on Sumatera Island on the Sunda Strait, which intersects with the Indonesian Archipelagic Sea Lane. The Indonesian Archipelagic Sea Lane is provided by the Government of Indonesia, an archipelagic country, as an international passageway for ships sailing through Indonesian waters from the Indian Ocean to the South China Sea and the Pacific Ocean, by implementing a traffic separation scheme that regulates traffic proceeding in opposite or nearly opposite directions by means of a separation zone or line, traffic lane, etc. The study is motivated by records of fatal accidents that have taken place in the strait, and a portrait of the congested crossing lane is provided. The concept of a traffic separation scheme and its implementation in the Sunda Strait is simulated, with the conclusion that the scheme could minimize potential collisions between ships sailing through the strait. Therefore, it is urgent for the government to implement the scheme.

Keywords: Archipelagic Sea Lane; Ferry crossing lane; Ship accident; Sunda Strait; Traffic separation

1. INTRODUCTION

As an archipelagic state, Indonesia is obliged to provide passageway to international merchant ships sailing through Indonesian waters, as required by the United Nations Convention of the Law of the Sea (UNCLOS) 1982, which has been ratified by the Indonesian government in Law No. 17/1985. This passageway is known as the Indonesian Archipelagic Sea Lane (IASL). Three Indonesian Archipelagic Sea Lanes have been established: IASL 1, passing through the South China Sea, Karimata Strait, Java Sea, and the Sunda Strait; IASL 2, passing through the Sulawesi Sea, Makassar Strait, Flores Sea, and Lombok Strait; and IASL 3, passing through the Pacific Ocean, Maluku Strait, Seram Sea, and Banda Sea (as stated in Government Regulation No. 17/2002 on the Indonesian Archipelagic Sea Lanes), as shown in Figure 1.

In addition, some ferry crossing lanes intersect with the IASLs as a means of connection between the many islands of Indonesia. In some of these intersecting lanes, there are high possibilities of ship accidents, ship collisions in particular, such as in the Sunda Strait, the

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Permalink/DOI: http://dx.doi.org/10.14716/ijtech.v6i6.1966

busiest ferry crossing lane in Indonesia. Fatal accidents that have occurred in this crossing lane include the collision between the Ro-ro ferry Bahuga Jaya and the gas tanker Norgas Chantika on 26 September, 2012 (Faisal, 2012) and on 3 May, 2014, between Ro-ro ferry Marisa Nusantara and cargo ship Qihang (Aditya, 2014). Both accidents occurred near the entrance of Port Bakauheni on Sumatera Island, when the Ro-ro ferries were crossing from Merak to Bakauheni while both Norgas Chantika and Qihang were sailing from the Indian Ocean to Singapore and the South China Sea. In these accidents, Ro-ro ferry Bahuga Jaya sank completely just a few minutes after the collision, claiming the lives of passengers, and Ro-ro ferry Marisa Nusantara was severely damaged, losing 24 of the vehicles it was carrying.

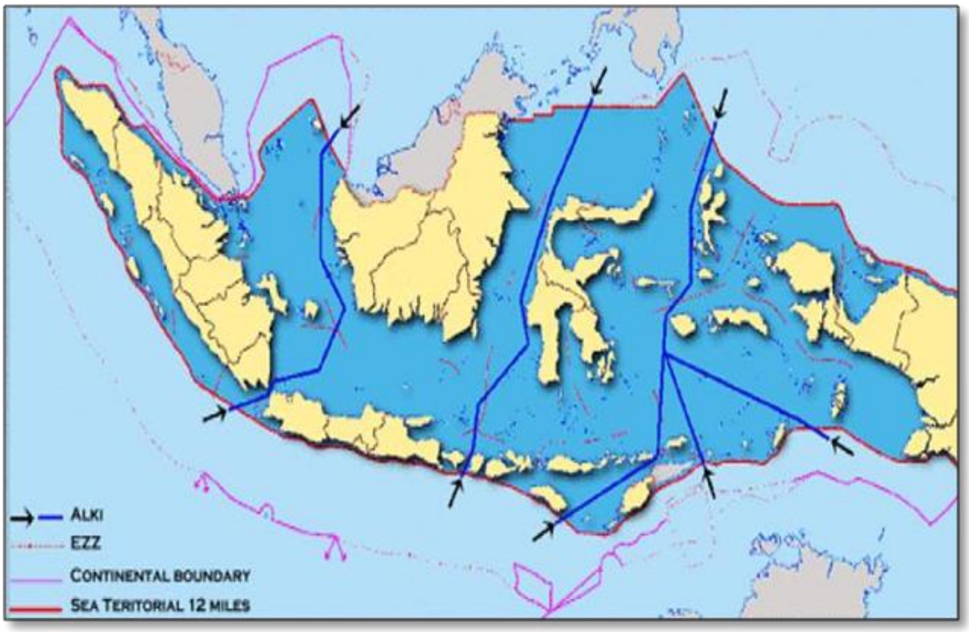

Figure 1 The Three Indonesian Archipelagic Sea Lanes (IASL)

2. METHODOLOGY

The methodology used in this study is mainly based on the modeling and simulation approach, which began with problem identification and the need to solve the problem, followed by defining the objective of the study. Comprehensive literature study and a field survey were conducted in order to collect reliable data and information related to the study. Traffic simulation and modeling were carried out and analyzed based on the data and information collected, and the results of the analyses were verified as the answer to the objectives of the study. The flow of the study framework is presented in Figure 2.

3. URGENCY IN ORGANIZING TRAFFIC IN THE SUNDA STRAIT

The crossing lane between the Port of Merak on Java Island and the Port of Bakauheni on Sumatera Island is the most congested lane in Indonesia. As stated by Berliana, (2012) and Wuragil (2009), approximately 40 ferries service this route, and around 150 crossings take place each day. Since the crossing lane is intersected by IASL 1, there is high potential for ship accidents, collisions in particular.

3.1. Portrait of the Traffic in the Sunda Strait

A portrait of the traffic in the Sunda Strait is necessary to determine the real situation. Analysis was started by investigating the geographical characteristics of the Sunda Strait, to determine at which points there were intersections and vessels entering the Sunda Strait.

The Sunda Strait, as stated by Pariwono (1999), has the narrowest width of 12 nautical miles (nm) between Merak Besar Island and Prajurit Island. On its southern side, Sangiang Island divides the Sunda Strait into two parts, east and west, as shown in Figure 3.

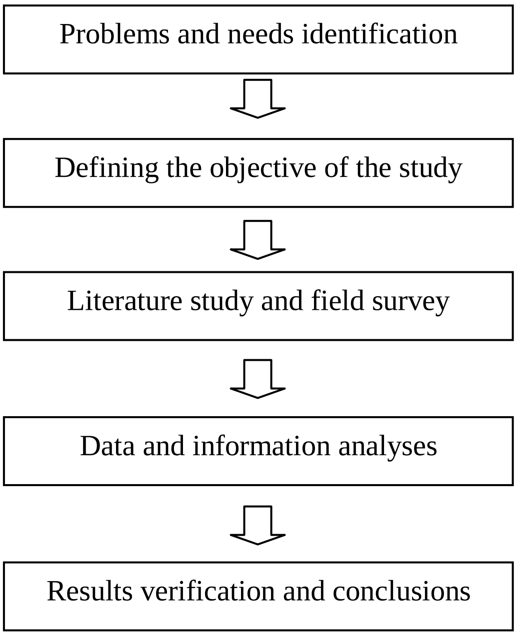

Figure 2 Flow of the study framework

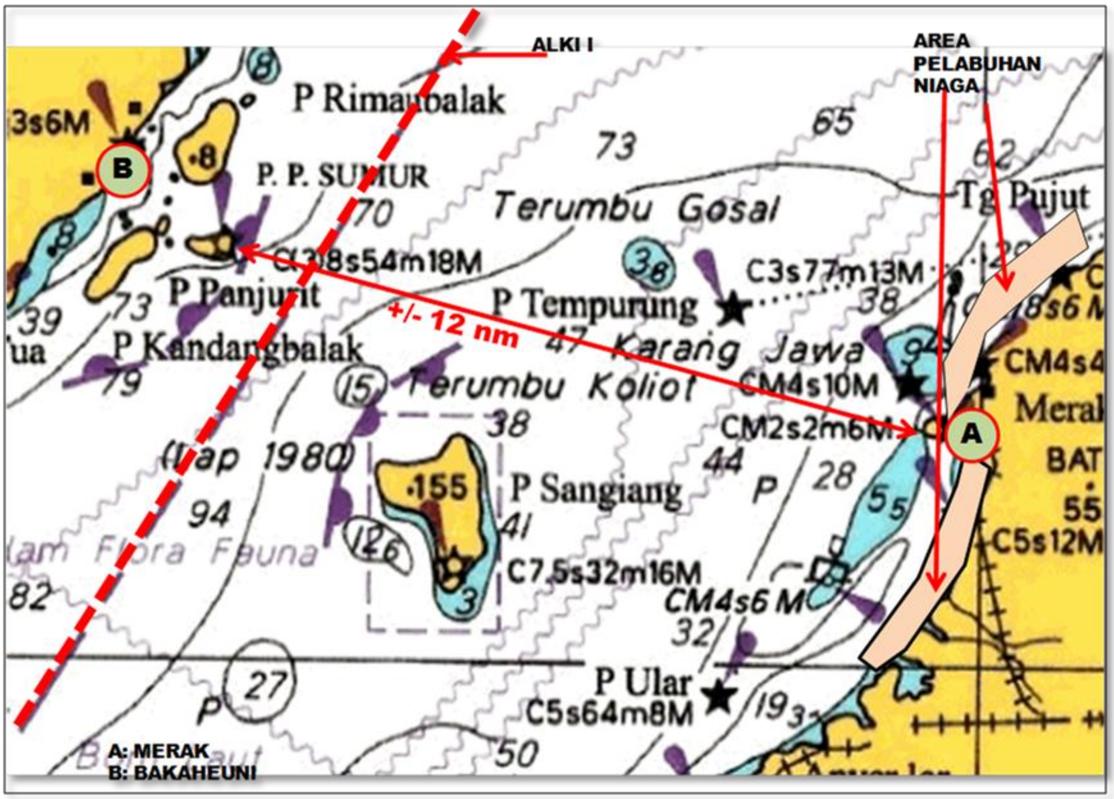

Figure 3 Geographical characteristics of the Sunda Strait

In general, the Sunda Strait has a depth of over 20 meters; on the Merak side, the water is shallower than on the Bakauheni side, and another shallow site is around the Gosal ridge on the west side of Tenpurung Island. At the site of Sangiang Island, the passageway is wider on the east side than on the west side, whereas, at the site of Tempurung Island, the passageway is narrower on the east side than on the west side. Apart from crossing ports, there are also some shipping and special ports on both sides of the strait, especially to the north and south of the Port of Merak. These areas are mainly industrial sites that have their own special ports, which make the traffic entering and leaving the passageway very congested.

The crossing lane between the Port of Merak (Point A) on the Java side and the Port of Bakauheni (Point B) on the Sumatera side has a distance of around 13 nautical miles. There are 41 ferries registered to serve this crossing lane, and an average of 130 to 150 crossings take place every day. This means that there are 4 to 6 ferries crossing every hour from each side of the strait, or one ferry for each nautical mile.

In order to capture the traffic pattern in the Sunda Strait, identification system devices were installed on the ferries operating in the crossing lane, and the crossing data were recorded by a special receiver. A processed and analyzed sample of the pattern is presented in Figure 4.

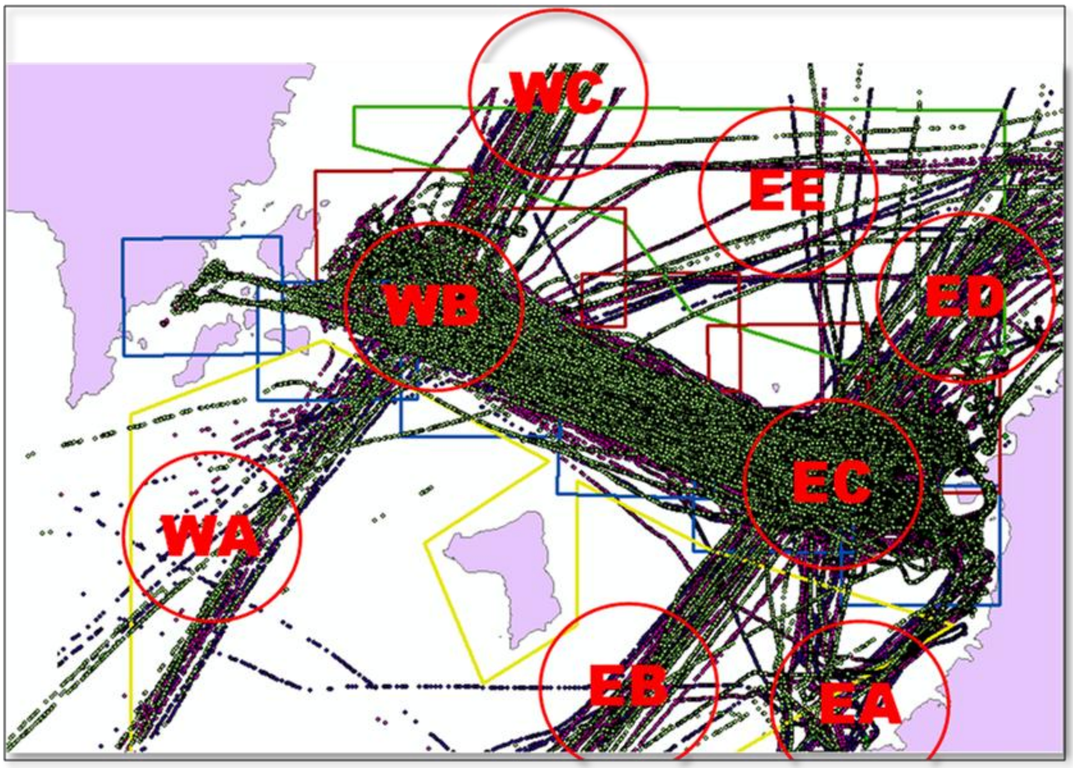

Figure 4 Sunda Strait traffic pattern

The pattern was divided into zones, i.e., WA, WB, and WC for the west side of the strait, and EA, EB, EC, ED, and EE for the east side of the strait.

In the WA zone, the width of the traffic lane is ± 3.9 nm, with an average of 10 to 15 ships passing each day. In the WB zone, the width of the crossing lane is ± 2 nm. In the WC zone, the width of the traffic lane is ± 2.3 nm.

In the EA zone, the width of the traffic lane is ± 3.2 nm; in this zone, ships enter and leave the industrial area in Banten Province. In the EB zone, the width of the traffic lane is ± 2.1 nm, with an average of 10 to 15 ships passing each day. In the EC zone, the width of the crossing lane is ± 2.7 nm. In the ED and EE zones, the width of the traffic lane is ± 2.5 nm.

From the above analysis, it can be concluded that the WB and EC zones are the most congested areas, where there are intersections, with 20 to 30 ships passing from north to south and vice versa, and approximately 8 to 12 ferries in the crossing lane.

3.2. Traffic Separation Scheme

The International Maritime Organization (IMO) defines "traffic separation scheme" as a plan that organizes traffic proceeding in opposite or nearly opposite directions by means of a separation zone or line, traffic lane, etc. The Traffic Separation Scheme (TSS) is regulated by the International Convention on Preventing Collision at Sea (COLREG) 1972 Rule 10 (Lloyd's Register Rulefinder, 2005a). The rule states that ships crossing traffic lanes are required to do so "as nearly as practicable at right angles to the general direction of traffic flow." This reduces confusion to other ships as to the crossing vessel's intentions and course, and at the same time enables that vessel to cross the lane as quickly as possible. If a vessel is obliged to cross traffic lanes, it should do so as nearly as practicable at right angles to the general direction of the traffic flow.

From the TSS rules, it is clear that crossing vessels that sail between two crossing ports will definitely intersect with the IASL 1 and have potential to collide with the vessels sailing on the IASL 1.

3.3. Responsibility of Ships in the Intersection Situation

The responsibility of ships is regulated by COLREG 1972 Rule 18 (Lloyd's Register Rulefinder, 2005c). It is stated that, "A power-driven vessel underway shall keep out of the way of: a vessel not under command; a vessel restricted in her ability to manoeuver; a vessel engaged in fishing; a sailing vessel." Therefore, this rule is not applicable to the WB and EC zones. Rule 15, however, which regulates the crossing situation, is more applicable. Rule 15 states that, "When two power-driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel" (Lloyd's Register Rulefinder, 2005b).

Based on Rule 15, four crossing situation simulations were carried out to illustrate the situations in zones WB and EC, as shown in Figure 5 for Situations A and B.

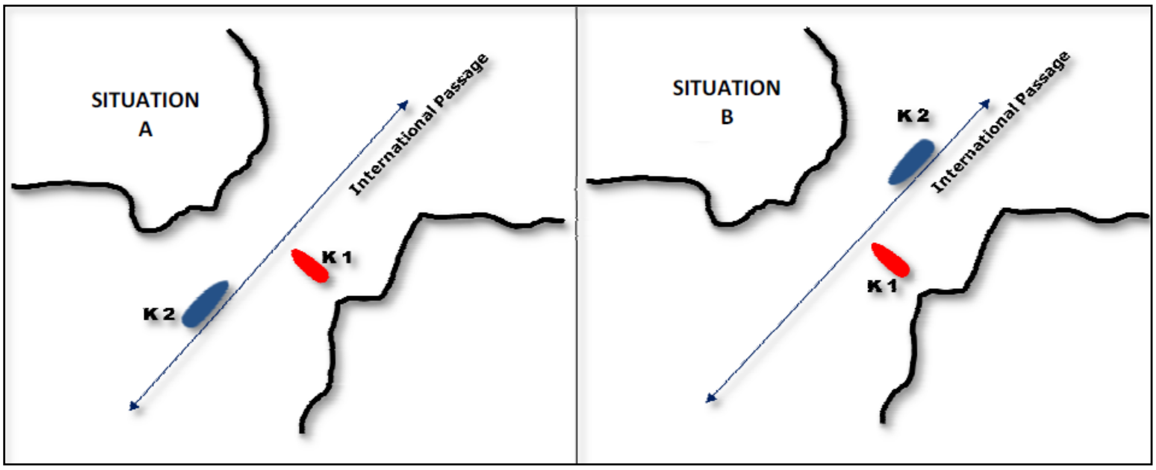

Figure 5 Simulation of situations A and B

In Situation A, Ship K2 has its bow heading north and Ship K1 has its bow heading west; in this situation, K2 should avoid K1, and K1 should keep on its bow and speed so that will not confuse K2. In Situation B, Ship K1 has its bow heading west and Ship K2 has its bow heading south; in this situation, K1 should avoid K2 by changing its course or reducing its speed. K1, as far as possible, should not cross in front of K2, while K2 should keep its course and speed. Figure 6 shows the simulation of Situations C and D.

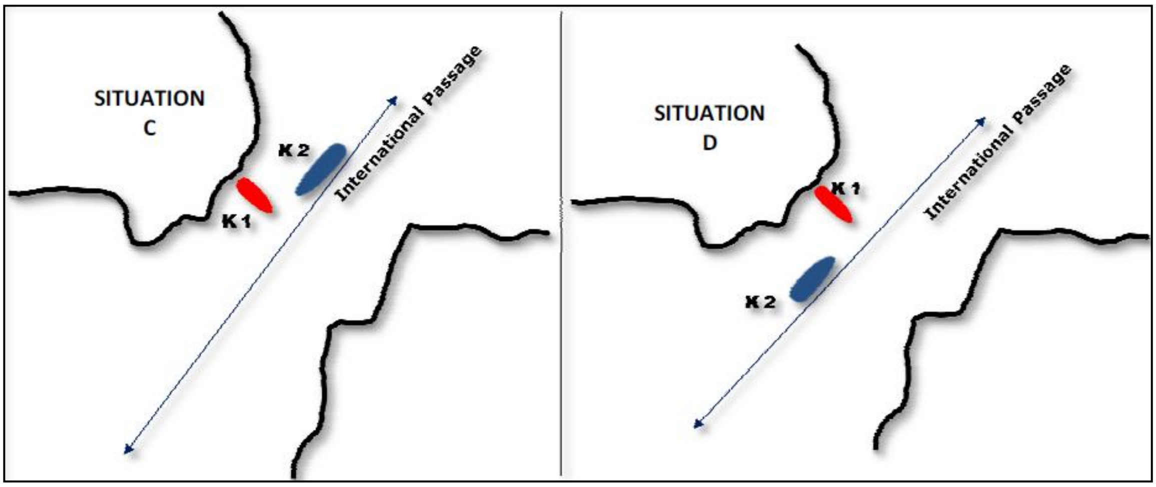

Figure 6 Simulation of Situations C and D

In Situation C, K1 has its bow heading east and K2 has its bow heading south; in this situation, K2 should avoid K1, and K1 should keep its course and speed. In Situation D, K1 has its bow heading east, and K2 has its bow heading north; in this situation, K1 should avoid K2, and K2 should keep its course and speed.

3.4. Responsibility of Ships if TSS is Applied in the Sunda Strait

The implementation of TSS in the Sunda Strait will bring responsibility to the ships sailing in it, as regulated by COLREG 1972 Rule 10, and the crossing regulation will not be applicable any more. To analyze the implementation of TSS, Figure 7 shows a simulation of the situation.

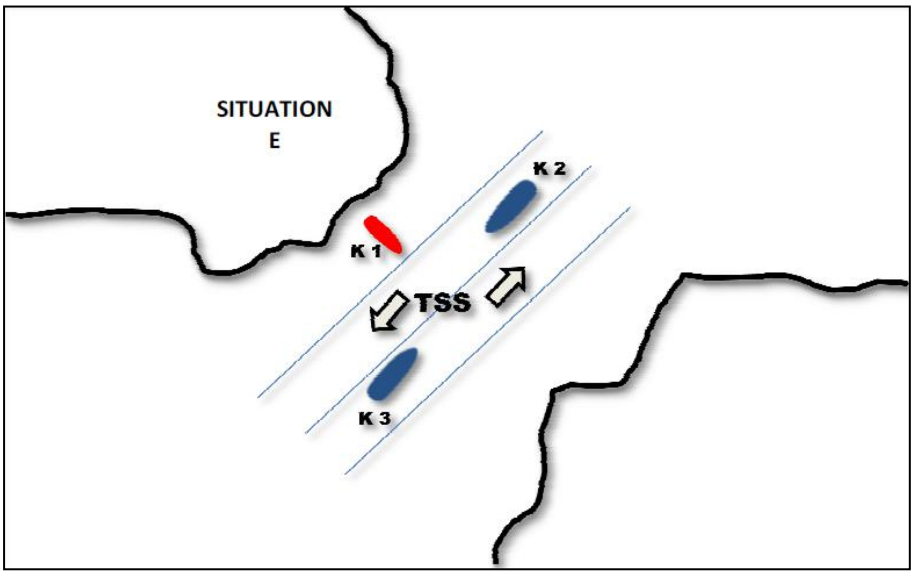

Figure 7 Simulation of TSS implementation

K1 has its bow heading to the east and crossing the TSS, K2 has its bow heading to the south using the TSS, and K3 has its bow heading to the north, also using the TSS. In this situation, both K2 and K3 should keep on sailing in the TSS, in accordance with TSS regulations. K1 should cross at right angles to the TSS, at the same time avoiding the path of ships using the TSS. In this case, K1 should avoid K2 and K3 in the crossing situation, which is different from Situations A, B, C, and D.

By following the TSS rules, vessels sailing both in IASL 1 and the crossing lane maintain responsibility, and collision between the vessels can therefore be avoided. The same scheme can also be applied on the east side of the strait, even though EA, EC, and ED are not international sea lanes, and the traffic is not as busy as on the west side of the strait. However, special study should be carried out before the scheme is implemented.

4. DISCUSSION

When TSS is implemented, all vessels sailing in the strait should fully obey COLREG 1972 Rule 10, and the authorities (in this case, the Indonesian government) should install a monitoring system to assure navigation safety in the Sunda Strait. Special piloting could be provided by the port authority for international vessels passing through IASL 1 to guide them through the TSS.

5. CONCLUSION

Based on the above simulations and analyses, the following can be concluded: (1) the implementation of the Traffic Separation Scheme in the Sunda Strait will assure the safety of vessels sailing both in Indonesian Archipelagic Sea Lane 1 and the ferry crossing lane between the Port of Marak and the Port of Bakauheni, and collision between vessels can be avoided; (2) it is urgent for the government to implement the Traffic Separation Scheme in the Sunda Strait, including a traffic monitoring system, as a solution to the congested traffic in the crossing lane between Merak and Bakauheni and its intersection with Indonesian Archipelagic Sea Lane 1, in order to maintain traffic safety in the strait.

6. ACKNOWLEDGEMENT

Sincere thanks are owed to officers and crew of the ferries who helped us and allowed us to install voyage monitoring systems on their ships so that accurate traffic data could be collected.

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