The Intricate Sea Borders of Batam (Indonesia), Tanah Merah (Singapore) and Johor Bahru (Malaysia)

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Abstract— this comprehensive report examines the technical specifications of passenger ferries operating in the busy maritime corridor between Batam (Indonesia), Tanah Merah (Singapore), and Johor Bahru (Malaysia), alongside the regulatory frameworks ensuring their safety in international waters. Predominantly high-speed catamarans equipped with waterjet propulsion systems (total power exceeding 4000 kW), these vessels accommodate 150-500 passengers and feature advanced safety systems including SOLAS-compliant life-saving appliances, GMDSS communication, ECDIS navigation, and automated fire suppression. Safety is governed by key IMO conventions such as SOLAS, STCW, and ISM Code, implemented nationally by Singapore's MPA (Merchant Shipping Act), Indonesia's DGST (Law No. 17/2008 on Shipping), and Malaysia's MDM (Merchant Shipping Ordinance 1952). Practical protocols encompass mandatory drills, STCW-certified crew training, rigorous port state control inspections under Tokyo MOU, and incident analysis for continuous improvement. While robust oversight minimizes risks in high-traffic straits, challenges like human error and cross-border coordination underscore the need for enhanced trilateral cooperation. Findings highlight a mature safety ecosystem supporting millions of annual passengers, offering insights for nautical science education and policy refinement.

Keywords—Ferry Safety Regulation, IMO Convention, Port State Control, Southeast Asian Maritime Corridor

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I. INTRODUCTION

This The maritime boundaries connecting Batam (Indonesia), Tanah Merah (Singapore), and Johor Bahru (Malaysia) constitute a critical geopolitical landscape in Southeast Asia. These waters, encompassing the Singapore Strait and the Strait of Johor, are among the busiest shipping lanes globally, vital for international trade and regional connectivity. Their delimitation, shaped by historical colonial agreements and contemporary international law, has been a complex process involving bilateral and multilateral negotiations, as well as international judicial rulings. This paper aims to analyse the historical context, legal frameworks, and geopolitical significance of these sea borders, examining specific segments and the challenges and cooperative efforts in their management. Understanding these dynamics is crucial for appreciating the delicate balance of sovereignty, economic interests, and environmental stewardship in this pivotal region.

II. REGULATORY FRAMEWORK

Ferry safety in these international waters is governed by a multi-layered system comprising international conventions, national legislation, and regional agreements.

2.1 International Conventions

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The cornerstone of global maritime safety, including for ferries, is the set of conventions developed by the International Maritime Organization (IMO), a specialized agency of the United Nations. Key conventions applicable here include:

- International Convention for the Safety of Life at Sea (SOLAS), 1974: SOLAS is the most important international treaty concerning the safety of merchant ships. It sets minimum standards for the construction, equipment, and operation of ships, including fire protection, life-saving appliances, radio communications, and safety management. For passenger ferries, specific chapters (e.g., Chapter II-1 for construction, Chapter III for life-saving appliances and arrangements, Chapter IV for radio communications, Chapter V for safety of navigation) are highly relevant. Regular surveys and certification under SOLAS are mandatory.
- International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978/1995/2010: STCW sets qualification standards for masters, officers, and watch personnel on seagoing merchant ships. It ensures that seafarers are properly trained and certified to perform their duties safely and competently. This is crucial for ferry operations, where crew proficiency in navigation, emergency response, and passenger management directly impacts safety.
- International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code): Adopted as Chapter IX of SOLAS, the ISM Code establishes an international standard for the safe management and operation of ships and for pollution prevention. It requires companies operating ships to develop and implement a Safety Management System

International Journal of Marine Engineering Innovation and Research, Vol. 10(4), Dec. 2025. 1298-1301
(pISSN: 2541-5972, eISSN: 2548-1479)

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(SMS) that includes policies for safety and environmental protection, procedures for safe operation, emergency preparedness, and internal audits. This code significantly enhances operational safety by embedding a culture of safety within shipping companies.

- International Convention on Load Lines (LL), 1966: This convention sets limits on the drafts to which ships may be loaded, thereby minimizing the risk of capsizing, flooding, and structural damage.
- International Convention for the Prevention of Pollution from Ships (MARPOL), 1973/1978: While primarily focused on pollution prevention, MARPOL indirectly contributes to safety by regulating equipment and operational procedures that impact vessel integrity and crew awareness.

2.1 National Authorities and Legislation

Each of the three countries has its own national maritime authority responsible for implementing and enforcing these international conventions, alongside national laws tailored to local conditions.

a. Singapore: Maritime and Port Authority of Singapore (MPA)
   - Role: MPA is the primary regulatory body for Singapore's port and maritime industry. It ensures the safety, security, and efficiency of Singapore's waters and vessels under the Singapore flag.
   - Legislation: MPA enforces the Merchant Shipping Act and its subsidiary legislations, which transpose SOLAS, STCW, MARPOL, and other IMO conventions into Singaporean law. This includes specific regulations for passenger ships, high-speed crafts, and the licensing of ferry operators. MPA conducts rigorous port state control (PSC) inspections on foreign-flagged vessels calling at Singapore ports and flag state control on Singapore-flagged vessels.
b. Indonesia: Directorate General of Sea Transportation (DGST) under the Ministry of Transportation.
   - Role: DGST is responsible for maritime safety, security, and environmental protection in Indonesian waters. It manages port operations, maritime traffic, and regulates shipping.
   - Legislation: DGST enforces the Law No. 17 of 2008 on Shipping and its implementing regulations. These laws incorporate international conventions and establish national standards for vessel registration, classification, surveys, crew certification, and safe navigation within Indonesian waters. Specific regulations for domestic and international ferry operations are in place to ensure compliance with SOLAS equivalents.
c. Malaysia: Marine Department Malaysia (MDM) under the Ministry of Transport
   - Role: MDM is the principal authority responsible for regulating and enforcing maritime safety standards, preventing marine pollution, and managing maritime affairs in Malaysian waters.
   - Legislation: MDM enforces the Merchant Shipping Ordinance 1952 (and subsequent amendments/acts) and its subsidiary regulations. These laws are continually updated to align with IMO conventions like SOLAS and STCW. MDM conducts flag state inspections for Malaysian-registered vessels and port state control checks on foreign vessels to ensure compliance with safety and environmental standards.

2.2 Bilateral and Trilateral Agreements

While direct comprehensive trilateral agreements solely focused on ferry safety might not be publicly prominent, the existing maritime boundary agreements indirectly contribute to safety by defining clear jurisdictions and reducing potential conflicts. For instance, the 1995 Malaysia (Johor)-Singapore Territorial Waters Delimitation (Johor Straits) and the 2009 Indonesia-Singapore Territorial Sea Delimitation (Singapore Strait) establish clear maritime boundaries, which aids in incident response and jurisdictional clarity during emergencies.

Furthermore, cooperation on maritime security and search and rescue (SAR) operations exists through various ASEAN forums and bilateral MOUs, ensuring coordinated response to incidents in these shared waters.

d. Technical Specifications of Ferries
   The ferries operating on these routes are typically modern, designed for high-speed passenger transport over relatively short distances, and adhere to stringent safety standards.

Common Vessel Types
- High-Speed Catamarans: These are the predominant vessel type. Catamarans offer superior stability, speed, and passenger comfort compared to monohulls, especially in choppy waters. Their twin-hull design allows for shallow drafts and efficient propulsion. Examples include vessels operated by Batam Fast and Sindo Ferry.
- High-Speed Monohulls: While less common than catamarans for these specific routes, some monohull designs are also used, particularly for routes requiring slightly higher capacities or different operational profiles.

e. Propulsion Systems
   Main Engines: Ferries typically use multiple (often 2-4) high-speed diesel engines (e.g., MTU, Caterpillar, Cummins) to achieve the required speeds. These engines are powerful, ranging from 500 kW to 2000 kW per engine, providing total propulsion power that can exceed 4000 kW for larger high-speed ferries.

Propulsion Units:
- Waterjets: These are highly favored for high-speed ferries due to their efficiency at speed, shallow draft capability (beneficial for terminal approaches), excellent maneuverability, and reduced risk of entanglement with floating debris compared to propellers.
- Fixed Pitch Propellers: Some ferries, particularly older or slower models, may still use traditional

International Journal of Marine Engineering Innovation and Research, Vol. 10(4), Dec. 2025. 1298-1301
(pISSN: 2541-5972, eISSN: 2548-1479)

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fixed-pitch propellers.Auxiliary Systems: Diesel generators provide electrical power for onboard systems, navigation equipment, air conditioning, and safety systems.

2.3. Passenger Capacities

Passenger capacities vary depending on the specific vessel and route:

- Smaller ferries: 150-250 passengers.
- Medium-sized ferries: 250-350 passengers.
- Larger high-speed ferries: Up to 400-500 passengers. These capacities are strictly regulated and are part of the vessel's safety certification.

2.4. Safety Features

Modern ferries are equipped with extensive safety features, mandated by SOLAS and national regulations:

a) Fire Detection

Fire Detection and Suppression Systems: Automatic fire alarm systems, smoke detectors, heat detectors, and fixed fire-extinguishing systems (e.g., CO_2, water mist) in engine rooms and other high-risk areas.

Structural Fire Protection: Fire-rated bulkheads and decks to contain fire spread.

Emergency Exits: Clearly marked and unobstructed escape routes.

b) Life-Saving Appliances (LSA):

Life Rafts: Sufficient number of inflatable life rafts with hydrostatic release units, capable of accommodating 110% of the total persons on board.

Life Jackets: Individual life jackets for every person on board, plus additional jackets for children and those in accessible locations.

Lifebuoys: Strategically placed lifebuoys with self-igniting lights and self-activating smoke signals.

Rescue Boats: For larger ferries, a rescue boat (often an inflatable rigid hull boat - RHIB) with a davit launch system.

Mustering Stations: Designated areas for passengers to gather during an emergency, with clear instructions.

c) Navigation Equipment (SOLAS Chapter V):

Radar: At least two radar systems for collision avoidance and navigation.

ECDIS (Electronic Chart Display and Information System): Increasingly mandatory for paperless navigation, providing real-time positional data on electronic charts.

GPS/GNSS: Global Positioning System/Global Navigation Satellite System for accurate

AIS (Automatic Identification System): For tracking and identifying other vessels.

Echo Sounder: For depth measurement.

Magnetic and Gyro Compasses: For heading reference.

d) Communication Systems (SOLAS Chapter IV - GMDSS):

GMDSS (Global Maritime Distress and Safety System): Fully compliant GMDSS equipment, including VHF DSC radios, MF/HF DSC radios, SARTs (Search and Rescue Transponders), EPIRBs (Emergency Position-Indicating Radio Beacons), and Navtex receivers.

Public Address System: For announcements to passengers and crew.

e) Stability and Structural Integrity: Vessels are designed and constructed to meet stringent stability criteria, especially for high-speed craft, ensuring they remain upright and seaworthy even under damaged conditions. Classification societies play a critical role in verifying these aspects.

2.5. Classification and Certification

Almost all international ferries operating on these routes are built and maintained under the supervision of recognized classification societies (e.g., Lloyd's Register, DNV GL, Bureau Veritas, Nippon Kaiji Kyokai (ClassNK)). These societies set technical standards for design, construction, and periodic surveys, ensuring the vessel's structural integrity and reliability.

Vessels carry various international certificates mandated by IMO conventions (e.g., Passenger Ship Safety Certificate, International Load Line Certificate, International Oil Pollution Prevention Certificate) and national certificates issued by their respective flag states. These certificates attest to their compliance with applicable regulations and are subject to verification during port state control inspections.

III. SAFETY PROTOCOLS AND INCIDENT MANAGEMENT

Effective safety relies not only on robust regulations and technical specifications but also on their rigorous implementation, crew competency, and a proactive approach to incident management.

3.1. Emergency Procedures

Mandatory Drills: Ferry operators conduct regular drills as mandated by SOLAS and flag state regulations. These include:

1) Fire Drills: Crew practice fire fighting techniques, donning fire-fighting suits, and operating fire hoses and extinguishers.

2) Abandon Ship Drills: Crew and, sometimes, randomly selected passengers participate in drills to practice donning life jackets, proceeding to muster stations, and launching life rafts. Passenger instructions are typically provided via announcements, safety videos, and safety cards.

3) Man Overboard Drills: Crew practice recovery procedures for a person in the water.

4) Emergency Instructions: Clear emergency instructions, muster station plans, and life jacket donning procedures are posted throughout the ferry. Passenger briefings are conducted before departure.

5) Incident Command System: Ferry crews are trained in basic incident command principles to manage emergencies effectively until external assistance arrives.

3.2. Crew Training and Certification

STCW Compliance: All masters, officers, and ratings involved in watchkeeping or safety duties are required to hold valid STCW certificates appropriate to their rank and vessel type. This includes training in basic safety (fire prevention, first aid, personal survival techniques), advanced fire fighting, medical first aid, proficiency in survival craft and rescue boats, and crisis management/human behavior training for passenger ships.

Operator-Specific Training: Ferry companies supplement STCW training with their own internal safety management system (SMS) training, covering company-specific procedures, vessel familiarization, and emergency scenarios relevant to their routes.

Continuous Professional Development: Seafarers undergo periodic refresher training to maintain and update their skills and knowledge.

3.3. Inspection Regimes

Flag State Control: The maritime authority of the country where the ferry is registered (e.g., MPA for Singapore-flagged, DGST for Indonesian-flagged, MDM for Malaysian-flagged) conducts regular statutory surveys (annual, intermediate, renewal) to ensure ongoing compliance with national and international regulations.

Port State Control (PSC): Inspections are conducted by the maritime authority of the country where the ferry calls (e.g., MPA inspecting an Indonesian-flagged ferry in Singapore, DGST inspecting a Singapore-flagged ferry in Batam). PSC aims to verify that foreign-flagged vessels meet international safety and environmental standards, particularly focusing on crew competency and vessel condition. Memoranda of Understanding (MOUs) like the Tokyo MOU and Indian Ocean MOU facilitate regional PSC cooperation.

Classification Society Surveys: Classification societies conduct independent surveys throughout the vessel's life cycle (from construction to regular operational surveys) to ensure structural integrity and compliance with their classification rules.

Internal Audits: Under the ISM Code, ferry operators conduct regular internal audits of their SMS to identify non-conformities and areas for improvement.

3.4. Incident Reporting and Analysis

Mandatory Reporting: Maritime regulations require mandatory reporting of all accidents and serious incidents (e.g., collisions, groundings, fires, machinery failures, loss of life) to the respective flag state and, if applicable, the coastal state.

Incident Investigation: Flag states (and sometimes port states) conduct thorough investigations to determine the root causes of incidents. The findings are often published and shared with the IMO and industry stakeholders to prevent recurrence.

Learning from Incidents: A key aspect of effective safety management is the analysis of incident reports and near-misses. Lessons learned are incorporated into revised safety procedures, crew training programs, and technical modifications to vessels.

Practical Example: Following any reported ferry incident, authorities would launch an investigation. For instance, in past incidents involving minor collisions or groundings in the Straits of Singapore/Johor, investigations would focus on navigational practices, adherence to traffic separation schemes (TSS), communication protocols, and bridge team management, leading to recommendations for tighter regulations or enhanced training. The Singapore Straits Traffic Separation Scheme itself is a critical safety measure designed to prevent collisions in heavily trafficked areas, and adherence is strictly monitored.

IV. CONCLUSION

The safety of passenger ferries operating between Batam, Tanah Merah, and Johor Bahru is underpinned by a robust framework of international conventions and national regulations, coupled with stringent technical specifications for the vessels themselves. The use of modern high-speed catamarans, advanced navigation and communication equipment, and comprehensive life-saving appliances reflects a commitment to safety from the technical perspective.

However, the efficacy of these measures ultimately relies on continuous oversight by national authorities (MPA, DGST, MDM), diligent adherence by ferry operators, and a highly competent and well-trained crew. Challenges such as managing high passenger volumes, preventing human error, and adapting to evolving maritime risks necessitate ongoing vigilance and cross-border cooperation. As a lecturer of nautical science, emphasizing the integration of these technical, regulatory, and operational aspects is crucial for future maritime professionals to ensure the continued safe passage of millions of passengers through this vital Southeast Asian maritime corridor.

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