Straits Project 13

New Study for the Safety of Navigation in the SOMS

Interim Report

Malacca Strait Council of Japan Japan Marine Science Inc.

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1. Background

In the Singapore Strait

Heavy traffic congestion within certain critical areas in TSS due to increasing number of vessels transiting with different destinations and speed.

40TH MEETING OF THE TRIPARTITE TECHNICAL EXPERTS GROUP Resorts World Convention Centre, Singapore 7-8 October 2015 OFFICIAL MEETING REPORT

The Meeting endorsed the proposals put forth by the Malacca Strait Council for the enhancement of the safety of navigation in the SOMS and agreed to approve as a Straits Project.

(i) two proposed studies on <u>the need and possibility to introduce speed limits and</u> <u>restrictions at certain area(s)</u> in the Traffic Separation Scheme, and another on <u>risk-</u> <u>mitigation measures concerning the entering and exiting by vessels in the Singapore Strait</u>
(ii) MSC to contract a consultant for the implementation of the studies; and
(iii) MSC to report on the outcomes of the studies at the 9th CF and 41st TTEG meeting in 2016.

The Meeting noted that Singapore would be the coordinating littoral State for the Straits Project.

- In the "Cooperation Forum (CF)" and "Tripartite Technical Experts Group (TTEG)" regarding with the Straits of Malacca and Singapore, <u>two studies that Japan side has proposed has</u> <u>been approved as the "Strait Project13".</u>
- In response to this, a simulation study has been carried out to analyze and recommend measures for further navigation safety in the Straits of Malacca and Singapore.

3. Evaluation Method <Formal Safety Assessment>

Formal Safety Assessment (FSA) methodology

- The proposed measures have been selected through Hazard Identification and Risk Assessment steps.
- > This simulation study focuses on Risk Control Options step.



Flow chart of the Formal Safety Assessment (FSA) methodology

- Reproducing the current marine traffic in the simulation model which is created based on the actual AIS data in the Singapore Strait.
- Estimating marine traffics in the two proposed scenarios, then comparing with the current marine traffic and verifying the improvements.





<u>Reproducibility</u> - Comparing ship track and density of track-

From AIS data





Reproduction in the simulation



Reproducibility - Comparing navigation position and speed distribution-



Position Distribution

Speed Distribution



4. Evaluation Index

1. Evaluation of Navigation Environmental Stress

Evaluation Index -> Environmental Stress Value (ES Value)

- Stresses received by the ship operator from the environment include static stresses (constraints of terrain, course shape, water depth, etc.) and dynamic stresses (constraints received from encounters with other ships).
- Magnitude of stress from both environments is evaluated by environmental stress evaluation; therefore, it is an index that can judge the permissible level of stress in the sea area from fixed judgment.

Judgment criteria (stress value)	Permissible level
Negligible (0 to 500)	Acceptable environmental stress for ship operator
Marginal (500 to 750)	Acceptable environmental stress for ship operator
Critical (750 to 900)	Acceptable environmental stress limit of ship operator reached
Catastrophic (900 to 1000)	Unacceptable environmental stress for ship operator

4. Evaluation Index



Situation of high Environmental Stress(ES) + surrounded shore, ships

+ TTC to other ships, shore is short

To convert mariners safety sense from TTC

SJ	Mariners Sense of Safty								
0		Extremely							
1	Safe	Very							
2		Moderate							
3	Not safe not danger								
4		Moderate							
5	Danger	Very							
6	T	Extremely							

To totalize mariners safety sense value around own ship. If mariners safety sense value is all 5 (=very danger), ES value becomes 900 (180*5). This ES value is classified as "Catastrophic" it means unacceptable environmental stress.

Evaluation Criteria	Mariners' Acceptable Level
Negligible (0 \sim 500)	Acceptable Environmental Stress
Marginal (500 \sim 750)	Acceptable Environmental Stress
Critical (750~900)	Acceptable Limit Environmental Stress
Catastrophic (900~1000)	Unacceptable Environmental Stress

2. Evaluation of Collision Risk

Evaluation Index → Collision Risk Value (CR Value)

From vessel tracks, Collision Risk Value is calculated by weighting according to the encounter corresponding to the extracted frequency of (1) overtaking, (2)head-on, and (3)crossing situation .



5 .Results of Simulation <Speed Restriction>

(1) Introducing speed restriction : West Area



Speed Restriction : 15kts , 10kts Applicable Ships : more than 500GT

5.Results of Simulation <Speed Restriction>



- becomes maximum around P.Takong Kecil where the width of passage route is narrow and shallows exist.
- With 15 kts speed restriction, effect to mitigate Environmental Stress was not • attained since very small number of ships navigated at more than 15 kts in the simulation.
- With 10 kts speed restriction, the average Environmental Stress Value decreased since the overtaking frequency decreased due to the speed restriction

5.Results of Simulation <Overtaking Restriction>

(2) Introducing overtaking restriction : West Area

Assumed overtaking-restricted areas \rightarrow 5 patterns





5.Results of Simulation <Overtaking Restriction>

Average ES values (Over 10,000GT)



- The average ES values decreased in all cases.
- Especially, in the area(1), that is longest distance, reduction effect is high.

5 .Results of Simulation < Overtaking Restriction>

Rate of occurrence of critical and catastrophic (All Ships)



- Rate of occurrence of critical and catastrophic decreased in all cases.
- Especially, in the area(1), that is longest distance, reduction effect is high.

5.Results of Simulation <Overtaking Restriction>

Collision Risk values (All Ships)

at Weastern part of Present Passage

	Actual			Restriction of Overtaking														
		Actual		AREA1			AREA2			AREA3			AREA4			AREA5		
	Head on	Cross	Over take	Head on	Cross	Over take	Head on	Cross	Over take	Head on	Cross	Over take	Head on	Cross	Over take	Head on	Cross	Over take
0-5GT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-20GT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-100GT	0	2	0	0	2	0	0	4	0	0	5	0	0	5	0	0	2	0
100-300GT	2	10	11	1	9	3	1	8	1	0	13	6	1	7	7	0	12	6
300-500GT	0	36	1	0	31	5	0	43	5	0	35	4	0	37	2	0	36	1
500-1000GT	0	9	7	0	5	1	0	7	1	0	5	3	0	8	5	0	10	9
1000-3000GT	0	12	10	0	10	4	0	9	9	0	11	8	0	10	6	0	10	7
3000-6000GT	0	19	20	0	11	14	0	26	15	0	26	19	0	21	25	0	16	16
6000-10000GT	0	13	25	0	7	12	1	12	27	0	14	26	0	13	24	0	6	16
10000-20000GT	1	39	18	0	21	8	0	29	21	0	25	11	1	29	19	2	36	18
20000-50000GT	0	125	97	0	93	34	0	94	60	0	107	56	0	120	85	0	117	89
50000-100000GT	0	33	38	0	28	21	0	25	36	0	34	40	0	24	46	0	25	29
100000GT-	0	10	14	0	10	7	0	10	9	0	14	14	0	14	8	0	13	17
sum	3	308	241	1	227	109	2	267	184	0	289	187	2	288	227	2	283	208
weight	1	5	2	1	5	2	1	5	2	1	5	2	1	5	2	1	5	2
risk	3	1540	482	1	1135	218	2	1335	368	0	1445	374	2	1440	454	2	1415	416
colision risk	2025			1354			1705			1819			1896			1833		



- CR values decreased in all cases.
- Especially, in the area(1), that is longest distance, reduction effect is high.

6. Conclusions and Way Forward

Speed restriction

When the restricted speed was \succ taken as 15 kts, effect to mitigate navigation Environmental Stress was not attained since very small number of ships navigated at more than 15 kts in the simulation.



- When the restricted speed was taken as 10 kts the average Environmental Stress Value decreased since the overtaking frequency decreased due to the speed restriction.
- > Some high speed ship types such may find it difficult to reduce their speeds to the restricted speeds; therefore, adaptability in setting the speed must be adequately considered. 19

6. Conclusions and Way Forward

Overtaking restriction

The overtaking restriction setting has the effect of reducing Environmental Stress and Collision Risk Values regardless of the length of the restricted area.



- Setting the overtaking restriction in the eastbound lane on the west side of the Singapore Strait is considered to be effective for improving safety.
- Further investigations are necessary on detailed operating methods such as location and length of overtaking restriction, applicable ship types, deep-water lanes, etc.

6. Conclusions and Way Forward

Way Forward

- The project has started to identify the hazards for the eastern side of the Singapore Strait and explore possible solutions using the simulation models.
- ➤ The project will continue to identify and analyze hazards and further possible solutions to substantially reduce or eliminate the identified risks associated with these hazards. These possible solutions may be studied by the same simulation method.
- The project 13 will keep on studying for details of these matters, particularly on restriction of overtaking, and will confirm the progress at the next Tripartite Technical Expert Group (TTEG-42).

Thank you for your kind attention