



HONG KONG CONVENTION COMPLIANT SHIP RECYCLING YARD DESIGN FOR UPTO 30,000 DWT SHIPS

Sunaryo^{1*}, Chandra P Rinaldi¹, Eko B Djatmiko², Siti Fariya³, Rafet E Kurt⁴, Sefer A Gunbeyaz⁴

¹Naval Architecture and Marine Engineering Study Program,
Universitas Indonesia, Depok, Indonesia.

² Department of Ocean Engineering, Faculty of Marine Technology, Institut Teknologi Sepuluh Nopember,
Surabaya, Indonesia.

³Naval Architecture and Shipbuilding Engineering, Institut Teknologi Adhi Tama Surabaya, Surabaya,
Indonesia.

⁴Department of Naval Architecture, Ocean and Marine Engineering University of Strathclyde, Glasgow, UK

*Email: naryo@eng.ui.ac.id

ABSTRACT

The study is aimed to design a ship recycling yard in Indonesia which comply to the requirements stated in the Hong Kong Convention for the Safe and Environmentally Sound Recycling of Ships with the capacity upto 30,000 dwt. The study was conducted based on information gathered from field and literature survey. It is estimated that there are approximately 1,400 ships in Indonesia have reached more than 25 years, which need to be replaced by the new ones and will be sent for recycling, but there is not any ship recycling yard that comply to the Hong Kong Convention requirements, and most of the ship recycling activities are carried out in traditional ways. It is expected that the proposed design will become a reference for ship recycling industry in Indonesia.

Keywords: *Hong Kong Convention, ship recycling yard, design, compliant.*

1. INTRODUCTION

Due to the implementation of Cabotage principle and Government incentive for importation of used ships from abroad the number of Indonesian national fleet increased significantly from 6,041 units in March 2005 to 24,026 units in June 2016 [1]. According to Indonesian National Ship Owners Association around 70% of the fleet consists of old ships, which have reached more than 20 years of age [2]. Roesdianto [3] stated that 20% of the fleet has reached 25 years and more or nearly 4,000 ships in total. In order to maintain their economical operation the old fleet need to be replaces with the new ones, and sent to the ship recycling yards as suggested by Sunaryo [4].

There is none ship recycling yard in Indonesia that comply to the International Maritime Organization's (IMO) Hong Kong Convention for the Safe and Environmentally Sound Recycling of Ships (Hong Kong Convention) [5], most of the ship recycling activities are conducted using traditional ways i.e. by beaching [6] the ship and after emptying the ship then progressively it is broken down into smaller sections manually using simple tools. Only a few ship repair yards carry out cleaner ship recycling procedures i.e. by towing the ship to the ground using slipway or to the floating dock. Effect of the beaching method is very harmful to the workers, people who live nearby, and to the environment because there are plenty of toxic gas, pollutants and hazardous materials from the ship that spill out and scatter around the shore, absorbed by the ground, or flow over to the sea and contaminate the food chain.

To minimise the negative effects of the unregulated ship recycling practises government of Indonesia has established some regulation related to ship recycling such as Regulation of the Ministry of Transport No. PM 29/2014 on the Prevention of Maritime Environmental Pollution. Chapter 51 – 56[7]; Shipping Law no. 17, 2008 [8], chapter 241, and 242 on Ship Recycling; Government regulation No. 101 year 2014 on Treatment of Dangerous and Poisonous Wastes [9], and in order to gain international recognition the Government is also preparing to ratify the Hong Kong Convention.

With regard to the above the study is aimed to design an environmentally friendly ship recycling yard that comply with the Hong Kong Convention with the capacity of vessel up to 30,000 dwt, using inflatable airbag for towing the ship to the concrete dry ground. It is expected that the design could become reference for future green and sustainable ship recycling yards in Indonesia.

2. METHODOLOGY

The study was started by identifying the current practises of ship recycling in Indonesia, existing and potential market of ship recycling both local and international for Indonesia, existing regulation related to ship recycling both national and international, and challenges for implementing environmentally friendly ship recycling yard in Indonesia which is in accordance to the Hong Kong convention. Primary data and information were collected through field survey in some ship recycling locations and secondary data were collected through literature survey.

Gathered information were used as basis for conducting gap analysis to review the voids and disparities between the requirements of Hong Kong Convention and the practices of the existing ship recycling yards in Indonesia. Findings of the gap analysis were then used as references for designing the proposed ship recycling yard.

3. SHIP RECYCLING

Ship recycling is defined by Hong Kong Convention as the activity of complete or partial dismantling of a ship at a Ship Recycling Facility in order to recover components and materials for reprocessing and re-use, whilst taking care of hazardous and other materials, and includes associated operations such as storage and treatment of components and materials on site, but not their further processing or disposal in separate facilities [10]. Ship recycling is not the same as ship breaking or ship dismantling. In ship recycling most of the ship's parts, components, and even inventory are reused or recycled. According to Ocampo and Pereira [11] in ship recycling process 70% to 80% consists of metallic materials that can be recycled, 20% to 25% consists of ship parts

and inventory that can be reused and only 2% to 5% of non-metallic waste that needs to be treated in waste treatment facility.

3.1 Hong Kong Convention

Hong Kong Convention is IMO's convention which aims to ensure that ships being recycled after reaching their end of operational lives do not create harmful risks to health and safety of people, and environment. The convention addresses all the issues related to ship recycling, beginning with the inventory of hazardous materials; preparation of the ship for recycling; ship recycling facilities and procedures; list of potential hazardous wastes; and waste treatment facilities, including their related certificates.

To assist the implementation of the convention some guidelines have been developed including Guidelines for the Development of the Inventory of Hazardous Materials [12]; Guidelines for the Development of the Ship Recycling Plan [13]; Guidelines for Safe and Environmentally Sound Ship Recycling [14]; and Guidelines for the Authorization of Ship Recycling Facilities [15].

3.2 Ship Recycling Practice in Indonesia

There is no proper understanding of environmentally friendly ship recycling practice in Indonesia, let alone comply with the Hong Kong Convention. Most of the ship recycling is conducted traditionally by beaching the ships to the shore and then are broken down using simple tools and equipments, without any consideration for the health; safety; and environmental hazards that are conceived by the activities. Only a few ship repair yards in Jawa and Batam carry out ship recycling in a more proper way, but are still not fully comply with the Hong Kong Convention.

3.3 Gap Analysis

Gap analysis is made to compare the current with the desired practices of ship recycling industry in Indonesia based on the IMO's approved international regulations and standards, such as Hong Kong Convention, and EU Ship Recycling Regulation as reported by DNV-GL AS Maritime [16].

Results of the gap analysis are as shown in table 1.

Table 1: Results of the gap analysis

Parameter	Current Practices	Desired Practices
Ship recycling process	Tidal beaching method is mostly being applied, ships are cut down on the beach using oxy-acetylene cutting torches without any ship recycling plan.	Comply with the Hong Kong Convention; works are conducted on dry platform to avoid spreading of pollution.
Environment	Hazardous pollution contaminates the environment and becomes threat to the community live in the surrounding vicinity.	Contamination to the environment should be prevented and handling of wastes are recorded
Health and safety	There are lack of health and safety working procedures in the ship recycling yards.	Health and safety monitoring for workers is mandatory.
Legal aspects	Most of the ship recycling activities is carried out illegally.	All the procedures should be legally approved by the authority.
Regulations	There are some national regulations related to ship recycling, but conflicting laws and regulations are also exist.	Integrated laws and regulations should be arranged to support the green and sustainable ship recycling industry.

3.3 Demands for Green and Sustainable Ship Recycling Industry

In line with the increasing global concern on sustainable and environmentally friendly industry, many developed countries make tight restriction on ship recycling activities such as European Union, which has its own regulations on top of the Hong Kong Convention, which only allow their ships to be recycled in the listed Hong Kong Convention compliant ship recycling yards as stated in Regulation (EU) No 1257/2013 [17]. Therefore many large ship recycling facilities in the world including India, Bangladesh, Pakistan, and Turkey are competing to comply with the Hong Kong Convention in order to grasp for world market.

Considering the global demand for green and sustainable ship recycling practices, Indonesian Government is preparing to ratify the Hong Kong Convention, and persuading the existing and planned ship recycling facilities to comply with the Hong Kong Convention, so that local ship recycling industry will gain international recognition and be able to participate in the global competition. This policy stimulates the concept of Hong Kong Convention compliant ship recycling yard design.

4. THE DESIGN

The design is based on the potential local and global market for ship recycling industry opened for Indonesia, even though for the time being the focus of the design is targeted for the local Indonesian market, since there are still some obstacles with regard to the regulations for importation of used ships intended for recycling. To simplify the study, the proposed ship recycling yard was assumed to be located in the existing ship building and ship repair region, without considering the geographical and supporting infrastructure requirements.

4.1 Design Criteria

In order to comply with the Hong Kong Convention requirements and referring to the size of most large existing Indonesian flagged ships, the ship recycling yard must ensure that no hazardous waste is contaminating the shore and water around the yard, and has the capacity large enough to cater at least large Indonesian flagged ships. Therefore the ship recycling yard is design with the capacity up to 30,000dwt, and all recycling activities are conducted on dry concrete platform.

4.2 Yard's Facility

The yard is designed to have concrete slipway berth with special ditches around it, to prevent drifted waste flows to the sea, instead of using graving or floating dock, which demand for higher investment costs. Since inflatable air bags are very popular for Indonesian ship repair yards to lift or launch ships, the same are also proposed to be used for lifting the ships to the concrete berth combined with sufficient capacity of towing winch.

For cutting activities, the yard is divided into primary cutting zone located next to the slipway for cutting ship blocks and large parts, and secondary cutting zone located farther from the slipway for cutting smaller parts. Most of the cutting is carried out using oxy-acetylene cutting torch and for cleaning the plates dry – ice blasting device is being utilized. For lifting ship blocks and large parts, mobile cranes are utilized especially on the primary cutting floor. Forklifts are utilized for moving ship parts in the secondary cutting floor; hydraulic grab claw excavator is used for moving ship scrap to the dump trucks. Ordinary and special containers are provided to collect both hazardous and non-hazardous wastes, dry as well as liquid wastes, which will be sent to waste treatment facilities when they are already full. Open air and covered stores are also provided to store the recycled materials and components.

Detailed capacity of the proposed yard's facilities is presented in table 2.

Table 2: The capacity of yard's facilities

Facility	Capacity	Quantity	Remark
Towing winch	200 tonnes	1	Can be switched for various towing
Inflatable airbag	98 kN/m	25	Diameter = 1.5 m
Dry ice blasting	20 – 100 kg/h	1	
Mobil crane	50 tonnes SWL	1	For block moving
	25 tonnes SWL	1	For part moving
Forklift	5 tonnes	2	
Excavator	20 tonnes	1	At 90 ⁰ boom
Container	33 m ³	1	For dry light waste
	33 m ³	1	For dry heavy waste
	1 m ³	6	For liquid waste

4.3 Yard's Layout and Arrangement

The yard layout is arranged as shown on figure 1, which has allotment as shown in table 3.

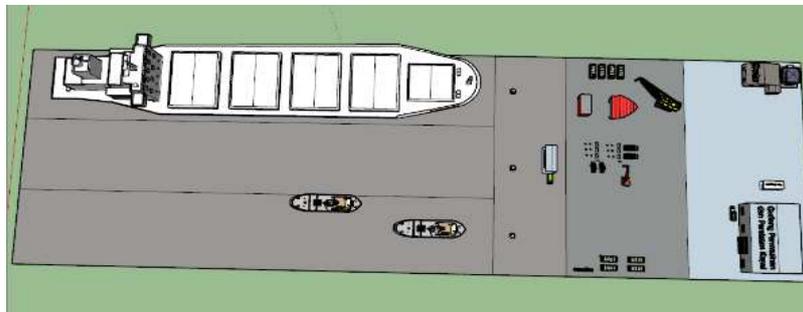


Figure 1: Yard layout

Table 3: Yard Arrangement

Number	Allotment
1	Slipways
2	Primary cutting zone
3	Secondary cutting zone
4	Recycled steel plate yard
5	Recycled components and parts store
6	Equipment store
7	Heavy vehicles parking area
8	Metal scrap collection area
9	Heavy dry waste collection area
10	Light dry waste collection area
11	Liquid waste collection area
12	Office building

5. CONCLUSIONS

There is none ship recycling yard in Indonesia comply with the IMO's Hong Kong Convention for the Safe and Environmentally Sound Recycling of Ships requirements. Most of the ships recycling activities in Indonesia are conducted using traditional method by beaching the ships to the shore, without considering its negative impacts to the environment. Only a few ship repair yards that carry out ship recycling pay more attention on the effect of their wastes to the environment, but they are

still far from complying to the Hong Kong Convention's requirements. With regard to the situation and the existing market opportunities a Hong Kong Convention compliant ship recycling yard is designed. The yard has the capability to cater local and global market, even though for the time being the design is targeted on the local market. The yard has the capacity to recycle ships up to 30,000 dwt, using inflatable airbags for lifting the ships to the concrete dry platform, and so preventing any pollutant flow down to the surrounding sea.

ACKNOWLEDGEMENTS

The authors would like to express their appreciation to the Newton Fund Institutional Link project No. 414709933 and Kemeterian Ristek/BRIN contract no. NKB-65/UN2.RST/HKP.05.00/2020 for providing funding to conduct the study. All related stakeholders which have supported the study.

REFERENCES

1. Saiful, 'The Number of National Ships is 24,026 Unit Per 2016' (Indonesian), *Indonesia Shipping Line*, <http://www.indonesiashippingline.com/>, 2018.
2. Hasbullah M., 2016, 'Development Strategy for National Shipbuilding Yards for Increasing Affectivity and Efficiency of National Shipping Fleet' (Indonesian), *Jurnal Riset dan Teknologi Kelautan vol. 14, no. 1*.
3. Roesdianto, T., 2017, 'Shipyard Management' (Indonesian). *IPERINDO*.
4. Sunaryo , 2019, 'Toward Green and Sustainable Ship Recycling Industry in Indonesia', Proceeding of 6th International Conference on Ship and Offshore Technology.
5. International Maritime Organization, 2009, 'Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ship', *IMO*.
6. Sunaryo, 2019, 'Toward Green and Sustainable Ship Recycling Industry in Indonesia', Proceeding of 6th International Conference on Ship and Offshore Technology.
7. Ministry of Transport Republic of Indonesia, 2014, 'Minister Regulation No. PM 29/2014 on the Prevention of Maritime environmental pollution' (Indonesian), Directorate of Sea Transportation.
8. Minister of Law and Human Right Republic of Indonesia, 2008, 'Indonesia Shipping Law no. 17, 2008' (Indonesian), Secretary Of State Republic Of Indonesia.
9. Secretary Of State Republic Of Indonesia, 2014, 'Government regulation No. 101, 2014 on treatment of dangerous and poisonous wastes' (Indonesian), Secretary Of State Republic Of Indonesia.
10. International Maritime Organization, 2009, 'International Conference On The Safe And Environmentally Sound Recycling Of Ships', *IMO*.
11. Ocampo E S and Pereira N N, 2019, 'Can Ship Recycling Be a Sustainable Activity Practiced In Brazil?' *Journal of Cleaner Production Vol. 2241*, 981-993.
12. International Maritime Organization MEPC Annex 17, 2015, 'Guidelines for the Development of the Inventory of Hazardous Materials', *IMO*.
13. International Maritime Organization MEPC Annex 2, 2011, 'Guidelines for the Development of the Ship Recycling Plan', *IMO*.
14. International Maritime Organization MEPC Annex 4, 2012, 'Guidelines for Safe and Environmentally Sound Ship Recycling', *IMO*.
15. International Maritime Organization MEPC Annex 5, 2012, 'Guidelines for the Authorization of Ship Recycling Facilities', *IMO*.
16. DNV GL AS Maritime, 2019, 'Site Inspection Report Application 026', DNV GL AS Maritime.
17. The European Parliament and the Council of the European Union, 2013, 'EU Ship Recycling Regulation (Regulation (EU) No 1257/2013)', *Official Journal of the European Union*.