Analysis of Ship-Collision Accidents in United Kingdom using MOP Model

Wanginingastuti Mutmainnah*, Masao FURUSHO**

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1. Introduction

The MOP (4M Overturned Pyramid) Model is a new model that can be utilized to describe the characteristics of the maritime traffic system, which is a Socio-technical environment system. This model has been utilized to characterize Indonesian and Japanese ship-collision accidents in previous studies. The lack of accident reports renders the analyses insufficient; thus, additional accident reports from other countries are needed.

Since 2014, we have developed a new model called the MOP (4M Overturned Pyramid) Model in order to determine the most common causative factor (CF) and then obtain the characteristics (Mutmainnah and Furusho, 2014). This model was utilized by Mutmainnah (2014) to analyze various accidents that occurred in Indonesia. It was found that each accident type should be analyzed separately because it has its own characteristics. Mutmainnah and Furusho (2015) analyzed collisions in Indonesia and Japan using the MOP Model and found that most of them occurred at night. However, they used a limited number of accident reports and did not consider the twilight time. To utilize the MOP Model widely, more accident reports are needed.

Herein, we present the analysis of ship collisions in the United Kingdom (UK) using accident reports obtained from the website of the Maritime Accident Investigation Board (MAIB) of the UK. We analyzed 32 collisions, including contacts (14 cases) that occurred between 2008 and 2013. The analysis was performed from several viewpoints, such as the three stages of accident development, ship types, and differences between collision and contacts. The objective was to determine the collision characteristics, including contacts, in the UK.

2. UK’s Ship Collision Accidents

From 2008 to 2013, the MAIB investigated 32 accidents. Those 32 cases included 18 collisions and 14 contacts. A collision means that two or more ships crashed, whereas a contact means that a ship crashed into a floating body, such as buoy or fixed structure, e.g., an offshore platform, wind turbine, or port.

In this study, we considered all the 32 cases, which involved a total of 53 ships. The analysis employed the accident reports provided on the MAIB website.

3. MOP Model

In order to satisfy the needed of describing the STE System in a simpler way, the authors modified The Septigon (Grech et al, 2008) and IM model from Furusho (2002) into The 4 M Overturned Pyramid (MOP) Model. The MOP Model is shown in fig. 1 as 3 Dimensional relationship looking like a sided inverted pyramid, where each factor is connected and affecting each other. In that model, Man Factor should always be at the bottom. This because Man Factor is the intrinsic factor that the most affecting matter to other.

In that inverted pyramid, each 4M Factor becomes the corner, connected to other factor by the edge. The edge line connections/ relation mean that each factor is affecting each other and of course affect the MTS because in some cases, error can come from the combination between some of the 4M Factors. This connection is named as line relation. Thus, there are 6 line relations on the edges that describe the MTS, namely M12 (Man-Machine Line), M13 (Man-Media Line), M14 (Man-Management Line), M23 (Machine-Media Line), M24 (Machine-Management Line), and M34 (Media-Management Line).

Fig. 1 MOP Model with epidemiological concept

There are three stages in the development of an accident: the beginning of the accident, the accident itself, and the evacuation process, which are labeled as Stages 1, 2, and 3, respectively (Nurwayhudi, 2014). When characterizing the accidents in the reports, the failure events at every stage of accident development are described. Several failures that occur are categorized into these stages. If we know the failures that occur at every stage until the evacuation process, we can predict the loss caused by the accident and develop countermeasures. These stages will be explained in detail in subsection 4.1 as part of the corner analysis.

4. Results and Discussion

The 32 collisions occurred in three types of places: the sea (14 cases), a river (5 cases), and port areas (13 cases). Of the cases that occurred at sea, 13 of the 14 cases were collisions; the other was a contact. In contrast, 10 of the 13 cases in port areas were contacts. The five river cases all occurred in the River Thames, which is very busy owing to the activities of numerous ports and ships.

The analyses were performed using the accident reports in two steps: a corner analysis wherein the causative factors (CF) were listed for each corner of the MOP Model and a line-relation analysis wherein the relationship between each CF in the corner was explored.

4.1 Corner Analysis

In this step, all of the failures that caused the accidents, i.e., the CFs, were traced and listed. They were then categorized according to the definition of each corner of the MOP Model.
The three stages of accident development were performed in this stage. Later, after all reports were analyzed from several viewpoints, we counted the number of failures. We determined that 27, 7, 8, and 15 CFs in M1, M2, M3, M4, respectively, contributed to the accidents, with 284 total failures in all the stages. In some cases, a single collision involved one, two, or more ships. Furthermore, one ship could have several CFs that caused failures in Stages 1, 2, or 3. Thus, the number of failures was far higher than the number of collision cases.

Of the 57 CFs, the most common were slipshod workmanship in maintaining a proper lookout, which caused 29 failures (in all stages for all ships), and darkness, which 32 out of 53 ships underwent. The former, improper lookout, occurred when seamen did not maintain utilizing or monitoring radar (11 failures), automatic identification systems (8 failures), and other navigational equipment (17 failures). The results for darkness indicate that ~60% of the ships were involved in collisions that occurred at twilight (18 ships) or night (14 ships).

There are several viewpoints for understanding the characteristics of the accidents using the results of the corner analysis. These viewpoints differ according to the types of accidents and the location/country. We characterized the collisions in the UK from three viewpoints: the three stages of accident development, ship types, and differences between collisions and contacts.

4.2 Line Relation Analysis

The CFs classified in the first step do not belong purely to one corner. The line-relation analysis step connects one corner to the other corners that are related to the CF, whether being caused by other factors or causing other factors. A CF in a corner that is related to another corner is mapped to the related corner, and then, the line relation that connects these corners is obtained. The line relation that connects M1 to M2 is labeled as M12. Thus, M23 indicates the line relation that connects the machine factor to the media factor.

In this step, for all the CFs listed, the relationships among the corners of the MOP Model were explored. By performing a line-relation analysis, we clarified which line relation was the most vulnerable to failure. To enable a comparison, the number of the relating mark was used as the causing ratio. The causing ratio for a corner is obtained by dividing the number of CFs that are related to the other corners by the total number of CFs in that corner.

5. Conclusions

Among the results presented in Chapter 4, three points are noteworthy regarding the characterization of the ship-collision accidents in the UK from 2008 to 2013.:

1. Slipshod workmanship (M1) often occurred on the bridge.

The most interesting CF related to slipshod workmanship involved maintaining a proper lookout and complying with conventions/rules. These two CFs caused 29 and 21 failures, respectively, and occurred in Stages 1 and 2, mostly in collision cases.

2. Darkness (M3), especially at twilight, was dangerous.

Out of 32 failures that occurred in darkness, 24 occurred in collisions, and 18 occurred at twilight. Therefore, twilight should be carefully considered to reduce accidents.

3. There was poor communication in performing operations (M4).

Unlike the two previous CFs, this one mostly occurred in contacts. It caused 8 failures, 4 of which occurred in COPTs, and 6 of which occurred in a port area. Typically, the pilot or superintendent did not share, i.e., brief, the plan of the operation, such as unloading and entering/leaving the port, and sometimes did not use English. These points will be discussed in detail in our future work.

4. The line relations affecting each corner differed.

As indicated in Chapter 4, the line relations differed among the corners. This means that all factors affected the others with no tendency.

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References


* 学生会員 神戸大学 大学院 海事科学研究科
mutmainnah_ship@yahoo.com

** 正会員 神戸大学 大学院 海事科学研究科