

## **TRANSPORTATION SAFETY IN THE INLAND WATERWAYS OF BANGLADESH: CHALLENGES AND MITIGATION OPTIONS**

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### **ABSTRACT**

Inland water transport is one of the most popular modes of transport in Bangladesh. It allows very easy access to any region of the country and is also cheaper than the other modes of transport. The aim of the study is to investigate the contemporary safety issues related to inland water transportation in Bangladesh. The statistical analysis is conducted based on the inland waterway accident data collected from the Department of Shipping and Bangladesh Inland Water Transport Authority (BIWTA). The study considers 268 accidental events during the period of 2005 to 2017 in which 438 vessels were involved. The analysis reveals that collision (57.8%) is the leading cause of inland water transport accidents. A major finding of the study is that cargo vessel is the dominant type of vessels responsible for the accidents. Besides most of the cargo vessels are foundered after the accidents. It has also been found that the major portion of the overall casualty is the fatality. The average fatality per accident ratio is high for the accidents related to stormy weather and overload & stability failure. Besides, most of the fatalities are involved in collision accidents. Dhaka to Barishal route has been found to be the most vulnerable waterway route in Bangladesh. During the study, it is found that many important factors and parameters of the accidental event are not reported properly due to a significant deficiency in the accident reporting system. Based on the analysis a number of recommendations have been put forward to mitigate the accidents in the inland waterways of Bangladesh and improve the safety situation.

**Keywords:** *Bangladesh, Inland waterway, Accidents, Passenger vessel, Transportation safety.*

## **1. INTRODUCTION**

Bangladesh is bestowed with numerous rivers and canals that are extended all over the country. This blessing from nature has allowed her to form an extensive inland water transport network throughout the breadth and length of the country. Despite the improvement of roadway, railway & airway transportation sectors, the inland water transport still plays a significant role in the transportation of a huge number of passengers and a significant amount of cargoes of the country. However, the safety situation of this vital mode of transport is disappointing to all. Every year many people are killed, some others are injured and reported missing due to accidents in the inland waterway. In the most recent decades, a number of catastrophic inland water transport accidents have been the depressing news for the whole world. At times these accidents have caused harmful effects on the environment. An investigation committee is formed by the government after each accident to identify the vital causes behind the accident and to generate some recommendations to stop such a loss in the future. Despite making significant efforts, the safety situation of the inland waterway is not improving and accidents are taking place in each year.

The prime objective of the study is to perform a statistical analysis based on the accident data of inland water transport accidents. The nature & type of accidents, involvement of types of vessels, types of casualties, location of accidents & eventual condition of vessels after the accidents are analyzed in this study. Based on the findings of the study a number of recommendations are put forward that can mitigate the accidents and thereby safety can be ensured in the inland waterways of Bangladesh.

## **2. LITERATURE REVIEW**

A number of studies have been carried out to address the safety issue of the inland waterways of Bangladesh. However, due to the inadequacy of accident data & information, the numbers of in-depth studies on maritime transportation safety are very few.

A study by Chowdhury (2005) was involved in the application of Geographical Information System (GIS) to reveal that most accidents occur during fair weather & good visibility condition. The study, therefore, concluded that human factors are highly responsible for the inland water transport accidents in Bangladesh. Awal (2007) stated that there are four main factors that are responsible for the maritime accidents of Bangladesh. These factors are related to vessel design, operating environment inside the vessel, education & enforcement, and human error. A study by Awal (2008) revealed that passenger vessels & cargo vessels contribute significantly to the total number of fatalities of inland water transport accidents. Rahman & Rosli (2014) proposed the concept of elevator operation to mitigate the accidents due to the overloading of the passenger ships of Bangladesh. Hossain et al. (2014) developed a fault tree as a tool for collision & grounding-type accidents and analysis of accident data to identify the hazardous chain of events. Islam et al. (2015) investigated the causes behind the water transport accidents in Bangladesh. The study concluded that the most combined form of occurrence of maritime accidents in Bangladesh is overloading combined with inclement weather. Uddin & Awal (2017) analyzed the inland water transport accidents from 2005 to 2015 to reveal that the numbers of accidents increase & decrease in a periodic manner which resembles a wave shape form. A study by Probha (2017) revealed that cargo vessels and passenger vessels mainly contributed to the accidents in the inland waterways of Bangladesh during the period of 2008 to 2015. Another important finding of the study is the average casualty per accident & average fatality per accident ratios are higher in the waterways in comparison to the roadways & railways. Raiyan et al. (2017) applied Event Tree Analysis method to analyze the maritime accidents of Bangladesh. The study concluded that the number of accidents can be reduced considerably if the problem of poor visibility when the vessel is overloaded can be solved.

### 3. ACCIDENT DATA COLLECTION AND METHODOLOGY

The data of inland water transport accidents have been collected from the Department of Shipping and Bangladesh Inland Water Transport Authority (BIWTA). This study considers 268 accidents during the period of 2005 to 2017 in which 438 vessels were involved. These accident data are usually documented in a textual form and there is no standard database to maintain these vital data & information. Many important technical parameters like types of vessel, time of accidents, names of rivers or canals etc. are found missing for many accidents. Furthermore, the exact location of accidents including latitude & longitude, route of accidents, dimensional characteristics (viz. length, breadth, depth & draft etc.) of the vessels, number of passengers or weight of cargo carried by the vessels before accidents etc. are not found to be recorded in those reports. Therefore, it has been observed that the current documentation system mainly focuses on legal issues rather than technical issues. As a result extraction of the technical information from these reports has been a burdensome task for this study. The Microsoft Excel software has been used for statistical analysis of the accident data and the results are presented in graphical form.

### 4. ANALYSIS

#### 4.1 Annual Distribution of Accidents and Casualties

The annual distributions of accidents and casualties in the inland waterways of Bangladesh are illustrated in figure 1. The annual distribution of inland water transport accidents suggests that the number of accidents follows a random pattern i.e. it fluctuates considerably over the years. The numbers of accidents remain above ten except the years 2013 & 2016. Besides, after the year 2010, the number of accidents remains below twenty-five; although it exceeds this figure in 2017 which is a very alarming issue. It is also observed that number of fatalities is comparatively higher than the number of injured & missing people i.e. fatality constitutes a greater portion of overall casualties. The annual distribution of fatalities shows that the trend of fatalities over the years follows the almost similar pattern to the trend of the number of accidents except the years 2005 & 2012.

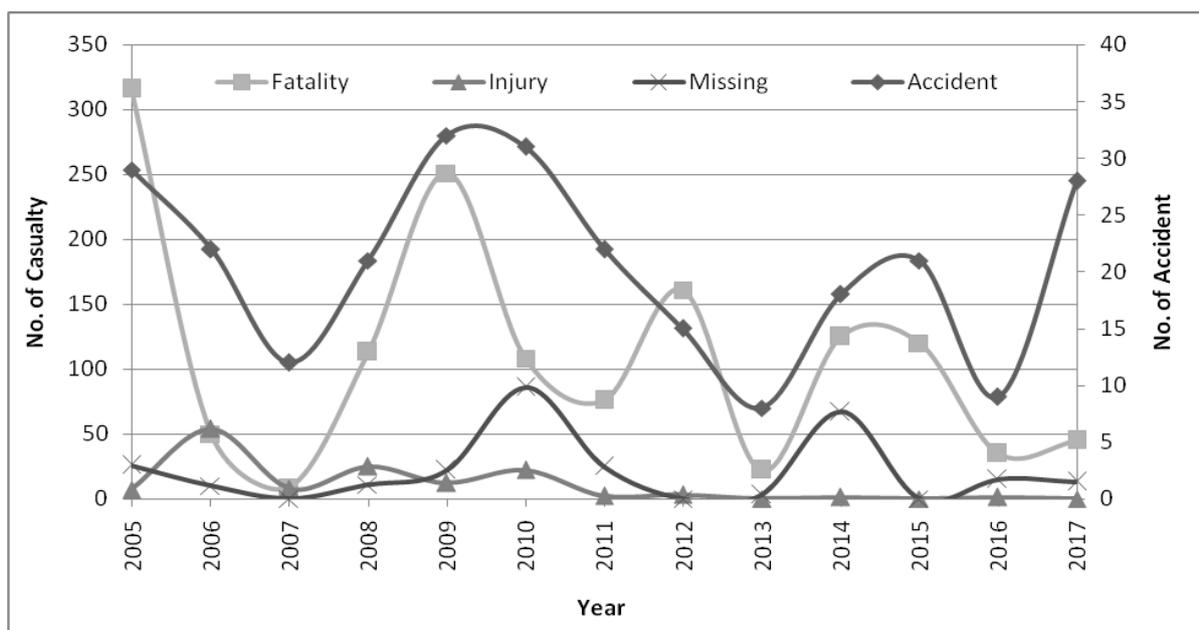


Figure 1: Annual distribution of accidents and casualties in the inland waterways of Bangladesh

During the analysis, it has been found that the high number of fatalities occurs mainly due to the accidents involving the passenger vessels. A single accident involving the passenger vessels has caused the death of more than a hundred people which is really a shocking issue. The number of injured people remains considerably lower in comparison to the number of fatalities. During 2006 the

number of missing people is above fifty. Apart from this year, the number of injured people is less than fifty throughout the mentioned range of years. During the years 2010 & 2014, the number of missing people has been found to be higher than any other year. An important fact needed to be discussed here is that the missing people are usually not found alive after the accident; rather their dead bodies are sometimes recovered after some days of the accident. Therefore, the numbers of missing people are reported based on recovering their dead bodies. In fact, they can be considered as killed in the accident.

#### 4.2 Annual Distribution of Accidents and Their Types

The annual distribution of number of accidents on the basis of accident types is illustrated in figure 2. It is observed that the collision of vessels dominates over all types of accidents. The shape of this curve for collision accidents is almost similar to the curve of overall accidents as shown in figure 1. The most probable reason behind such a huge number of collision accidents may be the operation of vessels by the unskilled operators & crews. Besides, the non-availability of the sufficient number of navigational aids on the waterway routes may be a significant causal factor. The occurrences of other types of accidents follow a random pattern over the years.

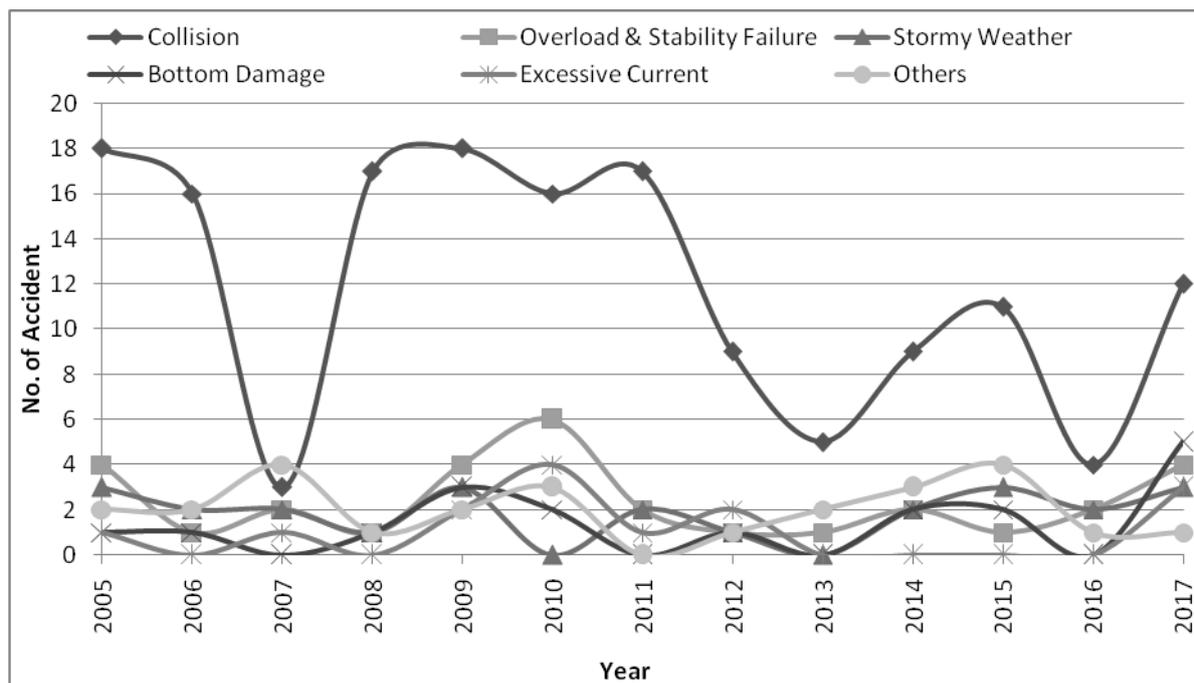


Figure 2: Annual distribution of the number of accidents on the basis of accident types

#### 4.3 Accident Types and Associated Fatalities

To identify the type of accidents that is highly responsible for the occurrence of a major portion of fatalities it is needed to distribute the number of accidents and associated fatalities based on the type of accidents. Figure 3 illustrates such a distribution to reveal this vital fact. It is observed that the numbers of accidents in the inland waterways of Bangladesh mainly occur due to collision (57.8%). Moreover, the number of fatalities involved in the collision accidents is also higher than any other types of accident. Therefore the mitigation of collision accidents will obviously reduce the number of accidents and associated fatalities in the inland waterways of Bangladesh. However, the number of fatalities involved in stormy weather and overload & stability failure is considerably higher with respect to the number of accidents; that is the ratio of average fatality per accident is higher for these two types of accident than any other types of accidents. This is due to the fact that the vessels usually capsize in these types of accidents and the people inside the vessels become unable to save their lives. The fatalities involved in the bottom damage, excessive current & other types of accidents are insignificant with respect to the overall fatalities.

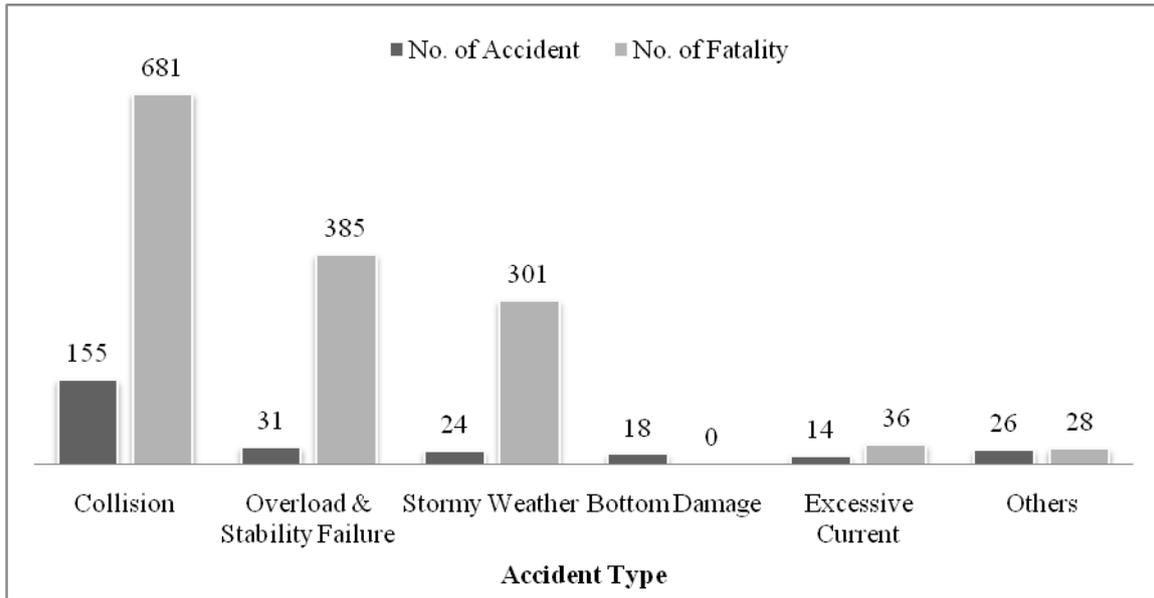


Figure 3: Distribution of accident types and associated fatalities

#### 4.4 Location of Accidents

The district-wise distribution of inland water transport accidents is illustrated in figure 4. It is observed that most of the accidents have occurred in the districts located in the southern zone of Bangladesh. The primary mode of transport in this zone of the country is the inland water transport. However, the occurrence of accidents remains as a great threat to the people those who travel by the waterway. Barishal, Chandpur, Munshiganj, Dhaka & Narayanganj are the noteworthy districts for occurrence of accidents which is under the renowned waterway route of the nation named as Dhaka to Barishal. The Meghna is the major river of this route that connects the major portion of the southern zone to the central zone of the country through the waterway. Apart from these districts, Chattogram, Khulna & Shariatpur are also notable districts for the occurrence of accidents.

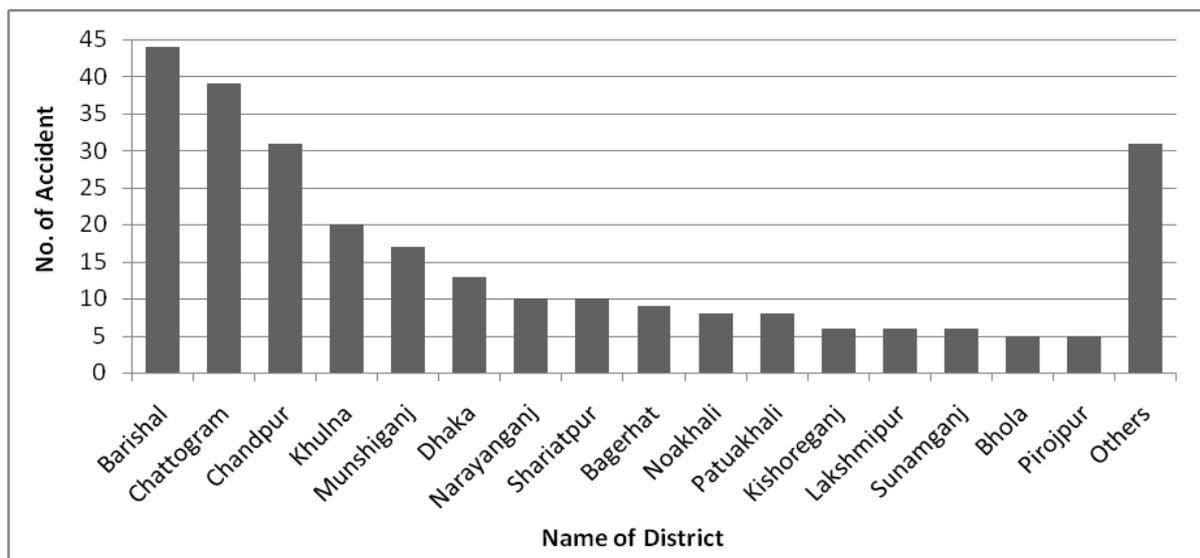


Figure 4: District-wise distribution of inland water transport accidents

#### 4.5 Involvement of Vessel Types in Accidents

The distribution of types of vessel involved in the inland water transport accidents is shown in figure 5. It is revealed that most of the accidents take place due to the involvement of the cargo

vessels (28%). Apart from this, passenger vessels also share a considerable percentage (23%) in the accidents. The accidents involving oil tanker (5%) sometimes has caused a detrimental effect on the natural balance due to spillage of oil from the damaged ships. Trawlers & country boats are generally made for carrying a low volume of cargo together with carrying few numbers of passengers occasionally. The main purposes of using these boats are not specifically mentioned in the accident report form maintained by the government authorities. Therefore it is very hard to categorize these boats into a particular vessel type. The most important fact is that the types of 32% vessels are not mentioned in those reports. As a result, it has created a serious barrier for this analysis as the actual percentage of involvement of the vessels is not revealed from this section of the analysis. This drawback should be removed by improving the maritime accident investigation & documentation process.

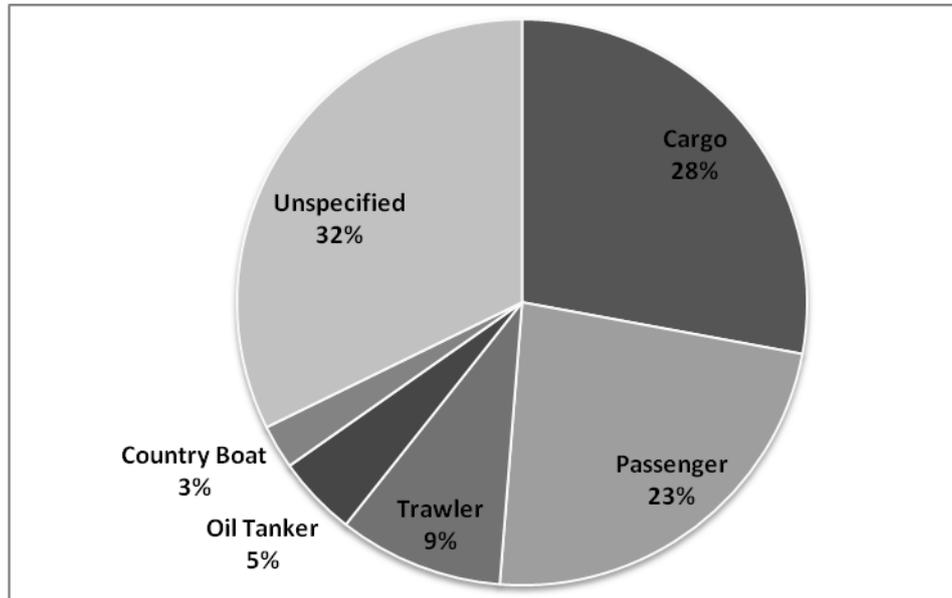


Figure 5: Distribution of vessel types

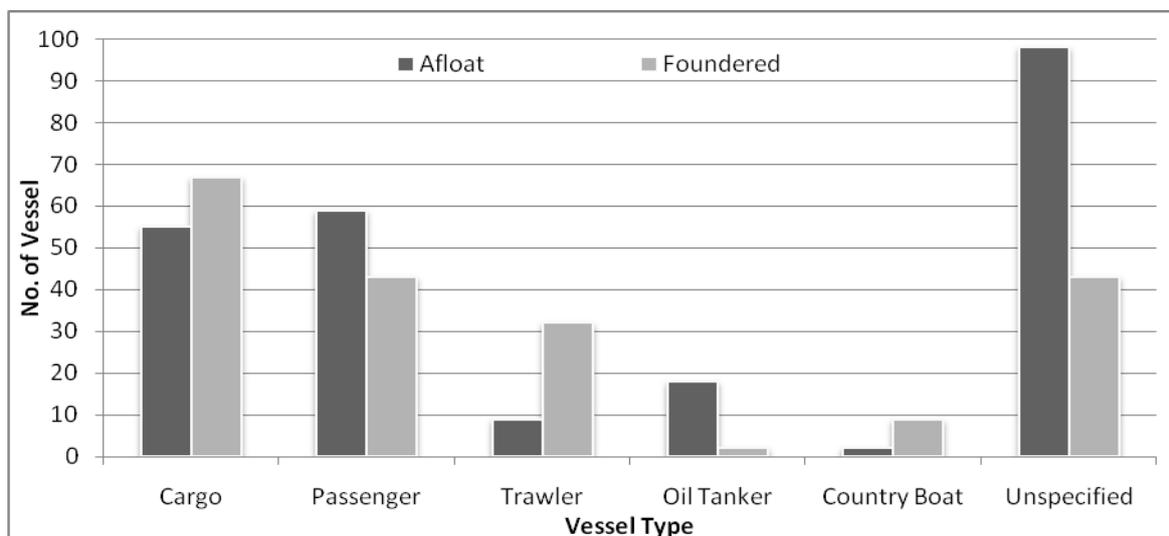


Figure 6: Distribution of the eventual condition of the vessels after the accident

#### 4.6 Eventual Condition of Vessels after Accident

The distribution of the eventual condition of the vessels after the accident is illustrated in figure 6. It is observed that most of the cargo vessels are foundered after the accidents. Ultimately a huge loss of

cargo & valuable properties takes place due to these accidents. However, the number of passenger vessels that are foundered is higher in comparison to the afloat ones. In spite of this fact, it has been found during the analysis that foundering of the passenger vessels has caused the most significant loss of human lives. Besides, most of the trawlers & country boats are foundered after the accidents. The main reasons behind this fact are that as these types of boats are usually small in structure, have no proper lighting system and usually move in the overloaded condition. Moreover, in the case of collision, these boats are usually hit by the larger vessels. The oil tankers usually remain in afloat condition than being foundered after the accident. However, when these tankers remain in floated condition even after being collided with other vessels, spillage of oil takes place that causes severe impact on the environment.

## **5. CONCLUDING REMARKS**

### **5.1 Research Findings**

The research findings of the study can be summarized in the following way:

- Collision (57.8%) is the major cause of accidents in the inland waterways of Bangladesh.
- Most of the fatalities are involved in the collision accidents.
- Fatality constitutes the greater portion of overall casualties in the inland water transport accidents.
- The average fatality per accident ratio is higher for the accidents related to stormy weather and overload & stability failure.
- The waterway route of Dhaka to Barishal is the most vulnerable for the occurrence of accidents.
- The cargo vessel is the dominant type of vessels for maritime accidents.
- Most of the cargo vessels are foundered after the accidents.

### **5.2 Recommendations**

On the basis of the above study the following recommendations can be made for ensuring the safety of inland water transportation system of Bangladesh:

- The availability of sufficient life-saving appliances should be ensured in all vessels to save the lives of the distressed people during any emergency situation. An important fact to be mentioned here is that there is still no law for keeping life jackets in the ships which is a matter of great concern. Therefore, immediate steps must be taken by the government authorities to issue new rules on this matter.
- Hazard analysis techniques should be applied to identify the underlying causal factors that are responsible for the occurrence of inland water transport accidents.
- The accident investigation & documentation process should be improved and relevant human resources should be trained up regularly. The recommendations of the accident investigation committees should be implemented within a very short period.
- The development of a standard maritime accident database is needed for analysis of accidents and to provide effective recommendations on the basis of the analysis.
- To check the fitness of the vessels, periodic & effective vessel survey should be conducted.
- The oil tankers should be constructed following the method of double-hull construction process to avoid spillage of oil after any accident. All existing single-hull oil tankers should be modified to the double-hull oil tankers.
- Maritime safety audits of all waterway routes, with special emphasis on the Dhaka to Barishal route should be conducted to ensure the safety of this popular route.
- The present search & rescue response mainly includes recovering the dead bodies and capsized or damaged vessels. Therefore, it should be improved so that human lives can be saved just after the occurrence of accidents.
- Adequate navigational aids should be fixed on the waterway routes to avoid accidents related to the collision.

- All unregistered vessels should be included in the registration process so that overall safety in the waterway can be ensured.
- Regular training programs should be conducted to enhance the skill of the masters, helmsmen, inland marine engineers, greasers, drivers & crews of the vessels.

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