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AN INVESTIGATION ON WATER TRANSPORT ACCIDENTS IN BANGLADESH

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ABSTRACT

Inland Water Transport (IWT) plays a very significant role in the transportation system of Bangladesh. Its low expenses and high accessibility compared with other alternative modes amplifies a great demand for carrying goods and passengers within the country. Although water transportation sector in Bangladesh possess geographical advantage but there are deficiencies in the safety aspect. This study has been aimed at collecting and analysing data of water transport accidents that occurred in the inland waterways of Bangladesh during 1995 to 2005. A total of 290 cases were considered for the study which primarily included accidents of passenger vessels, cargo vessels and various types of country boats. It has been observed that the number of accidents increased significantly over the years and most predominant causes of accidents were found to be adverse weather condition, collision and overloading. Several recommendations have been put forward regarding further in depth accident analysis and improvement on enforcement and behavioural modification of the transport operators and users with a vision to develop a safer and sustainable water transport system for the country.

Keywords: Inland Water Transport, Accident Characteristics, Bangladesh.

1.0 INTRODUCTION

Bangladesh is a low lying alluvial land with thousands of rivers and creeks running towards the Bay of Bengal from the upstream of the neighbouring countries like India, Nepal and Myanmar. About seven percent surface of the Bangladesh is covered by twenty four thousand

kilometre long river network. The country has about nine thousand square kilometre of territorial waters with seven hundred and twenty kilometres long coast line and twenty thousand square kilometre of Economic Resources Zone (ERZ) in the Indian Ocean. The confluence of the rivers forms the world's largest delta here (Banglapedia, 2005). About two-thirds of the land is vulnerable to flooding. Most areas remain under water for two to five months a year. As a result, the costs of development and maintenance of roads and railways are high. On the other hand, inland water transport (IWT) has always been a natural and relatively cheap means of transport. In certain areas, it is the only mode of transport.

The IWT system in Bangladesh is both extensive and well-connected with the rest of the transport system. In terms of traffic intensity, the inland waterway network generates about one and half million passenger-kilometres per route-kilometre of waterway (BER, 2004). The density of inland ports and terminals is much higher with approximately three and half berthing facilities per one hundred route-kilometres. The density of passenger facilities on the inland waterways is also high at around forty per one hundred route-km. It is therefore, the Government's policy to consider IWT as an essential mode of transportation for building a balanced multimodal transport system to confront the development challenges of Bangladesh.

With the increase in population and the growing economy of the country, the waterways are getting congested despite the fact that the inland waterways are not expanding. Therefore, the problems attribute to maritime safety are emerging with new dimensions every day. In Bangladesh maritime safety have become a severe issue in quick succession when a number of passengers launch capsized killing several thousands of people within the past few years. In response to such emergencies, the government took some remedial measures which by some degree provided noticeable improvement to the safety scenario. However, the fact still affrights all is that accidents are still taking place and often appear to be devastatingly fatal. The extent of damage and loss of property are tremendously expensive which severely puts substantial amount of burden on the national economy. In Bangladesh there yet remain numerous deficiencies on maritime safety and the scope for improvements in this aspect is a contemporary demand. This study is therefore, an attempt to provide an insight to the accident characteristics of the inland water transports of Bangladesh based on studying the incidents that took place over the last decade. The purpose of this paper is also to provide an explicit idea on the pattern of accidents so that the

problems can be easily comprehended and necessary actions can be taken by the appropriate authorities to stop such devastations.

2.0 BACKGROUND STUDY

A number of studies have been investigated during this research work and it was observed that most studies highlight the water transport accidents as isolated events particularly blaming the individuals directly related to maritime safety rather than delineating the problem as a flaw in the system. For example, The Report of the Task Forces (1991) avers that the fundamental problem relating to the inland shipping safety is that the private operators do not follow the rules and regulations for ship design, construction and operations. This is why their vessels lead to disastrous and fatal accidents in the waterways of the country. Preponderance of private sector in the inland water makes the assessment of operational efficiency difficult. Also, the private operators do not maintain regular and authentic statistics.

Similarly, some research concentrated on modification and augmentation of the rules and regulations of inland water transports studying events that appeared extremely devastating. Bangladesh Transport Sector Study (1994) have classified the waterway accidents focusing on identification of broad types of waterway accidents and suggested several remedial measures commensurate with the classification of inland water transports. BIWTA (2003) having constraints of accident investigation system highlighted the safety and stability parameters of the passenger vessels plying within the inland waterways of Bangladesh.

Chowdury K.H. (1986) identified the reasons and remedies of passenger launch accidents in Bangladesh which attributed stability problems with design and overloading of passengers and cargo. Some research findings by Khalil and Tarafder (2004) discussed the issue of design modifications for improving the extra initial stability by upward shift of centre of gravity and thereby preventing the vessels from capsizing in times of emergency. Chowdhury (2005) attempted to develop a GIS based accident information system for water transport accidents and recommended future research to be conducted on navigational system integrated with meteorological forecasting systems.

It was observed that due to deficiency in accident data very few studies have so far been conducted on identification of the accident characteristics from the macro perspective. For example, some statistical analysis has been published by Awal (2006) in an attempt to identify the accident characteristics dealing with 197 accidents (passenger and cargo ships) which showed that majority of the accidents in the inland

waterways of Bangladesh occur due to the effect of overloading and/or cyclone (43% of total accidents). However, the deficiency of the research was that the actual number of accidents was much higher than the studied number of accidents. Similarly another investigation by Awal, Islam & Hoque (2006) dealt with 67 accident cases (passenger ships only) and brought some interesting findings to light. It was ominous to note that 56 percent of the passenger vessel accidents in Bangladesh end up in collision due to human error. The second largest cause was the loss of stability due to Nor'wester and overloading (21%). however, the results were still inconclusive because of insufficient accident data.

Nevertheless, it could be understood from the studies that there are indeed sufficient scope of research and improvement in the field of accident analysis and investigation. Advances in such an area will definitely help improving the safety of water transports; particularly studying the accident characteristics will provide the base line information for generating specific actions and countermeasures. Therefore, one of the objectives of this study is to collect and analyse the accident data of inland water transports more authentically and sophisticatedly.

3.0 METHODOLOGY

3.1 Data Collection and Methodology

The primary goal of this study is to compile and maintain a technical accident database working as a tool for in-depth accident analysis. Therefore, emphasize have been given on collection of accident data from various sources such as Daily Newspapers, reports of Department of Shipping (DOS) and Bangladesh Inland Water Transport Authority (BIWTA). It was observed that DOS and BIWTA store accident data essentially for legal purposes and give more emphasis on the parameters related to legal issues. Therefore, extractions of scientific data from these reports are very much cumbersome, time consuming and in most of the cases impossible. The problem even amplifies in the case of news paper reports which naturally put emphasis of the subjective matters rather than the technical parameters. Therefore, compilation of the database takes a pain staking cross matching with different sources of individual accidents in order to fill in a complete individual accident report. However, a total of 290 accident cases (occurred in between year 1995 to 2005) are being considered in this study and a database has been developed using Microsoft Access which comprises nineteen different parameters. These parameters are then grouped in to six major categories as shown elaborately in the database tree (Figure 1).

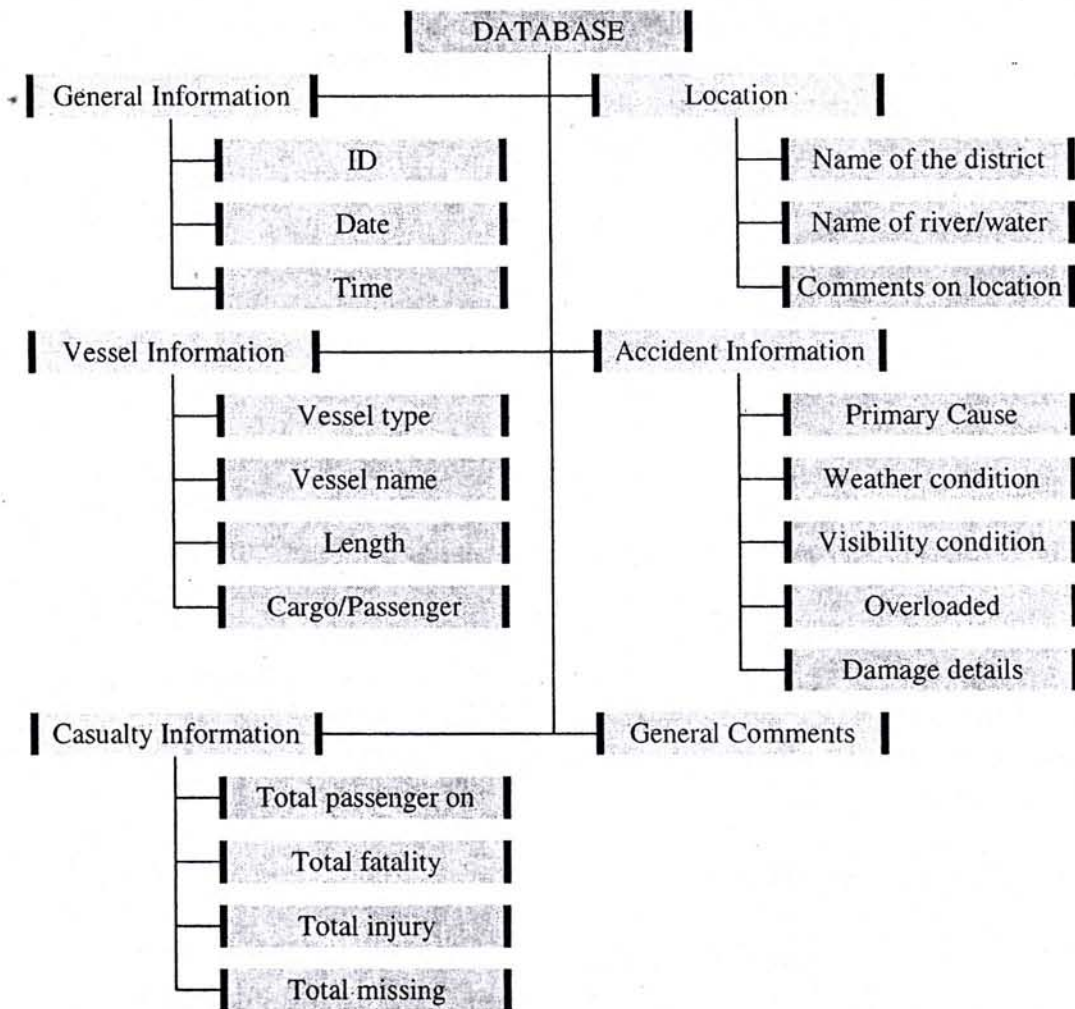


Figure 1: Accident Database Structure

The accident data was analysed using Microsoft Excel and the results have been represented in both tabular and pictorial forms. Attempt has been taken to keep the representation of the results as explicit and unambiguous as possible.

4.0 ANALYSIS AND DISCUSSION

Five major types of accidents were defined in this study, such as Accidents due to inclement weather (nor'westers and storms), Accidents due to collision, Accidents due to excessive current, Accidents due to physical/mechanical failure and Accidents due to other causes (rush of passengers, fire, large waves & whirlpools, etc). Table 1 shows the frequency of accidents based on different types of accidents and Figure 2 shows their respective percentages. It is quite evident from the analyses that accident due to inclement weather and accident due to collision are

the major types of accidents in Bangladesh (34 and 35 percent respectively). The percentage of under reporting was however found significantly less than the other analyses which are shown later. The rise in number of accidents over the years was the most alarming finding of this study. During 1995-1999 periods there were sixty three reported cases, but unfortunately the number jumped to two hundred and five for the period 2000-2005, which is around seventy one percent of the total accidents.

Table 1: Distribution of Accidents According to Accident Type

Accident Type	Frequency for Occurrence of Accidents		Total
	1995-1999	2000-2005	
Accident due to inclement weather (nor'westers and storms)	17	74	91
Accident due to collision	20	74	94
Accident due to excessive current	6	15	21
Accident due to physical/mechanical failure	4	15	19
Accident due to other causes (rush of passengers, fire, large waves & whirlpools, etc)	16	27	43
Total	63	205	268

Percentage of underreporting 7.58

There might be several possible reasons behind this swell in the total number of accidents for the 2000-2005 periods. One of them might be the increase in the exposure of water transports in the inland waterways due to the growing economic activities. Such demand indeed put considerable pressure on the supply of water crafts and also the required human resources (such as masters, captains and others) to support the systems.

As a result the quality of both products and services deteriorated and safety of passengers and goods were considered as secondary issue. Perhaps another reason of this increase in number of accidents is that more accident data have become available in recent times since media have given a boost in reporting the water transport accidents more comprehensively.

The analysis on accident type-month cross tabulation is shown in Table 2 where the month wise distribution of various types of accidents for 1995 to 1999 period and 2000 to 2005 period are presented in separate columns. As far as total number of accidents are concerned, it is quite evident from the table that accidents due to inclement weather occurred most in the month of April and May during the period of 2000-2005. On the other hand collision type accidents occurred mostly in the months of August, November and December during the year 2000 to 2005. However, the rest of the accidents seem to be more or less evenly distributed all over the years.

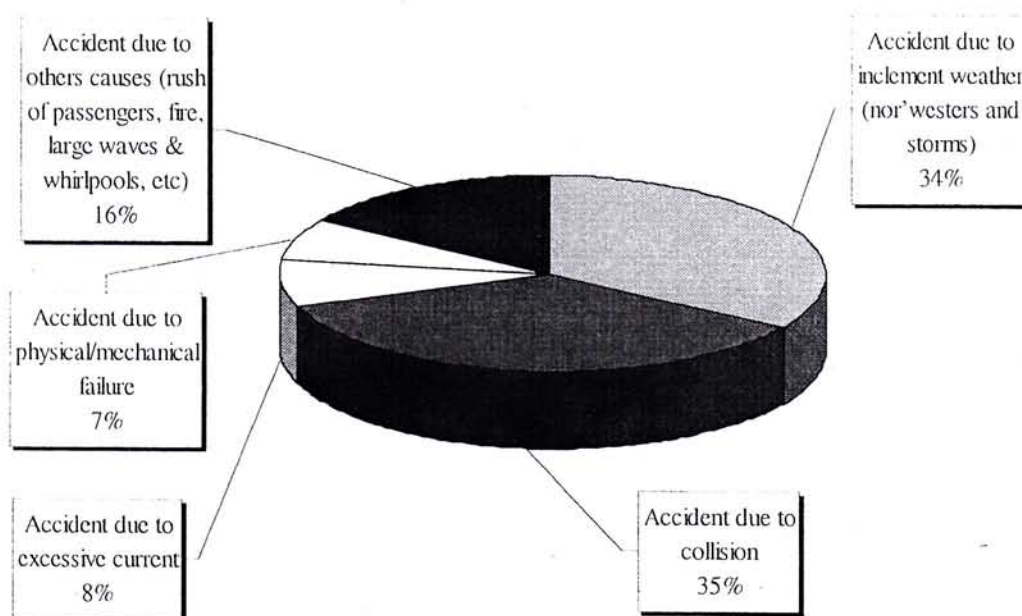


Figure 2: Overall Percentages of the Frequency of Accidents in Bangladesh

One of the most striking characteristics of water transport accidents is that these accidents are extremely fatal and thereby fatality per accident is higher than any other modes of transportation in the country. As an example, for road traffic accidents in Bangladesh, a fatal incident is considered "major fatal accident" if the fatality exceeds three or more persons per accident. In the case of water transports, the average fatality per accident is nineteen, which is more than three times of the defined major fatal road accidents.

Table 3 shows the total number of fatality and injury along with per accident figures for the defined major accident types. It is observed from the table that for the accident due to inclement weather' fatality per accident is alarmingly higher and way over average (29 per accident).

On the other hand for collision type accident the figure is eleven fatalities per accident which is again indeed higher than the major fatal road accidents. However, it is also noticeable that accident due to other causes (rush of passengers, fire, large waves & whirlpools, etc) are also generating higher rates of fatality (25 fatality per accident).

Table 2: Accident Type Month Cross Tabulation

Month	Frequency of Occurrence According to Accident Type										Total
	Accident due to Inclement Weather		Accident due to Collision		Accident due to Excessive Current		Accident due to Physical/Mechanical Failure		Accident due to Other Causes		
	1995-1999	2000-2005	1995-1999	2000-2005	1995-1999	2000-2005	1995-1999	2000-2005	1995-1999	2000-2005	
January	0	0	3	1	0	2	0	0	2	0	8
February	0	3	2	2	0	0	0	2	0	1	10
March	2	9	1	8	1	1	0	1	0	1	24
April	2	13	3	6	0	1	0	0	1	1	27
May	3	27	1	4	0	1	0	2	1	1	40
June	1	5	1	4	3	2	0	5	3	5	29
July	4	3	1	8	1	3	1	2	1	7	31
August	2	2	1	10	1	1	0	0	3	2	22
September	1	5	2	5	0	2	0	1	1	0	17
October	2	5	4	9	0	2	0	0	0	2	24
November	0	1	0	10	0	2	3	0	1	2	19
December	0	1	1	10	0	0	0	0	3	3	18
Total	17	74	20	77	6	17	4	13	16	25	269

Percentage of underreporting 7.24

Another important fact that can be observed from the table is that water transport accidents are relatively less injurious as compared with the rate of fatality. The average injury per accident is found to be six injuries per accident and it is almost four times less than the rate of fatality per accident. Table 3 suggest that the highest injury per accident is thirteen per accident for accident due to other causes (rush of passengers, fire, large waves & whirlpools, etc) which is also more than twice the average value.

Table 3: Fatalities and Injuries for Different Types of Accidents

Accident Type	Total No of Fatalities	Fatalities per Accident	Total No of Injuries	Injuries per Accident	Total No of Accidents
Accident due to inclement weather (nor'westers and storms)	2609	29	453	5	91
Accident due to collision	1046	11	413	4	94
Accident due to excessive current	160	8	125	6	21
Accident due to physical/mechanical failure	114	6	102	5	19
Accident due to other causes (fire, rush of passengers, large waves, etc.)	1069	25	545	13	43
Total	4998	19	1638	6	268

The time band analysis (Table 4 and Figure 3) suggests that most of the accidents due to inclement weather occur during the afternoon period stretching up to midnight. This is due to the reason that most of the nor'wester/storms in Bangladesh occur in the evening period. It also became apparent from the investigation that collisions occurred more during night time suggesting ill functioning of search light, navigation

light, captain's fatigue at late night and/or captain's incompetence in navigation.

However, from overall perspective it is observed in Figure 3 that sixty six percent of all accidents occur in between the twelve noon to midnight. An important aspect of this analysis is that most of the accidents in Bangladesh go underreported as far as recording of accident time is concerned. It is observed from the underreported column that eighty accidents had no time records in the primary source which is indeed a significant value in comparison to the total number of accidents and indeed interrupts the analysis.

Table 4: Time Band Analysis for Different Types of Accidents

Accident Type	Time Bands					Total
	00:00-05:59	06:00-11:59	12:00-17:59	18:00-23:59	Unreported	
Accident due to inclement weather (nor'westers and storms)	4	10	21	24	32	91
Accident due to collision	10	12	14	26	35	97
Accident due to excessive current	2	4	9	4	2	21
Accident due to physical/mechanical failure	1	3	8	1	6	19
Accident due to other causes (fire, rush of passengers, large waves, etc.)	2	13	8	6	12	41
Total	19	42	60	61	87	269

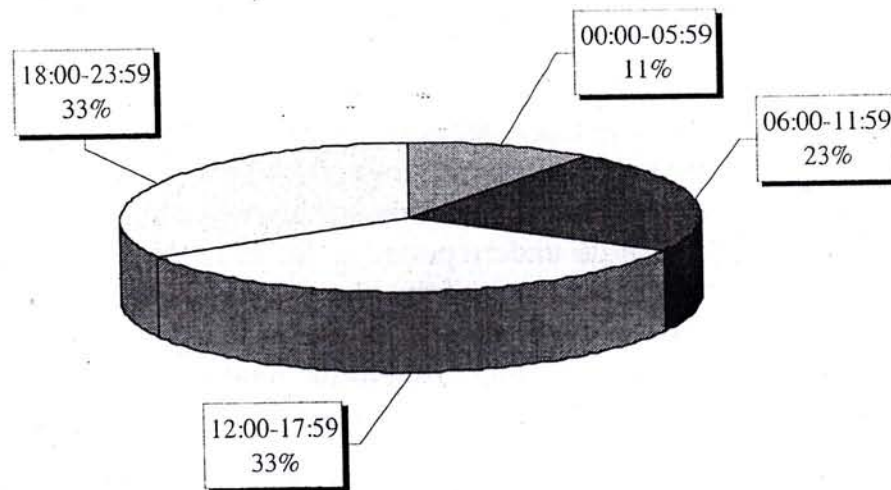


Figure 3: Occurrence of All Accidents for Different Time Bands

The Geographical Information System (GIS) analyses of six divisions of Bangladesh suggest that the most accident prone area of the country are Dhaka, Barisal and Chittagong divisions as it is depicted in Figure 4. The figure represents the total number of accidents, fatalities, injuries and missing in bar diagrams for the six divisional headquarters of Bangladesh. It is also learnt from the figure that among the top three divisions, in Chittagong most of the fatalities have taken place although most of the accidents took place in Dhaka and Barisal division.

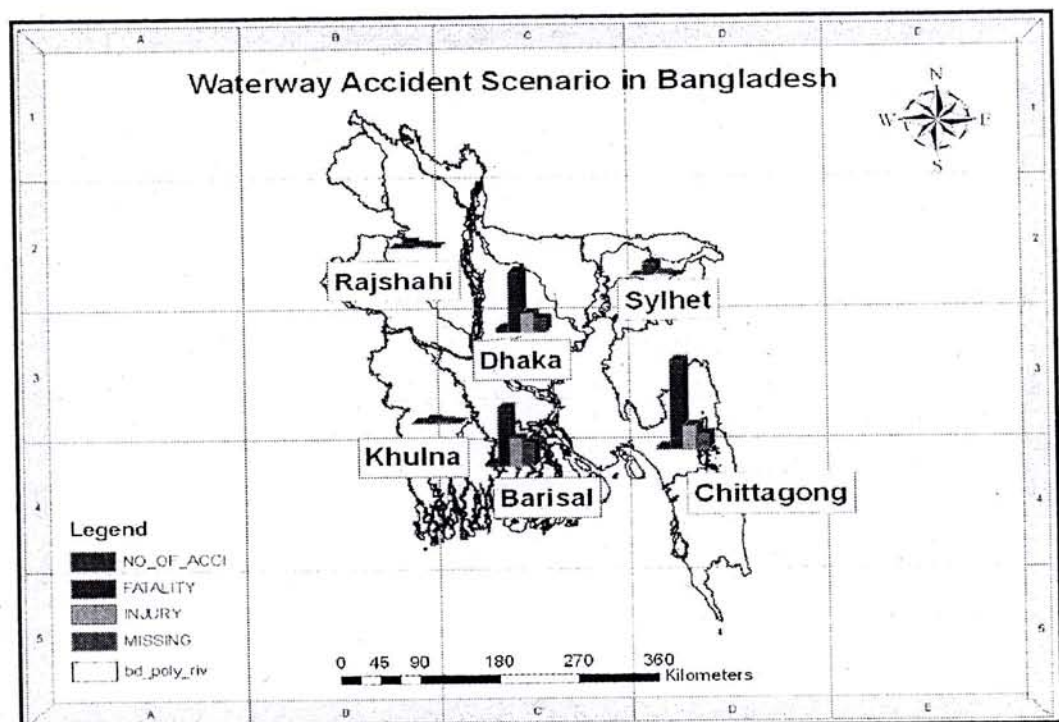


Figure 4: Spatial Representation of Casualties for Different Divisions on the Map of Bangladesh

4.1 Causes of Accidents

This study identified some of the fundamental causes of accidents which are grouped according to the major types of accidents are as following:

- Accident due to inclement weather (nor'westers and storms): Each and every water transport has certain limit of rolling angle (known as range of stability) up to which it can prevent capsizing if disturbed from the equilibrium position. The threshold limit beyond which a vessel loses stability is called the angle of vanishing stability. But storms causing strong waves and severe winds push the vessel to roll over the limit and lose its stability and finally capsize. Secondly, heavy rain stored into the under decks due to absence of water tight bulkheads and lack of adequate pumping facility, the water crafts tend to lose their stability at relatively small angle of inclination due to free surface effect.
- Accident due to collision: A large number of collisions at night and in foggy weather as well occur due to faulty lighting system, sirens, necessary navigational instruments and overall awareness of the ship master and or captain. Also collision while arriving and departing port/launch terminals are observed to be fatal and disastrous in many instances.
- Accident due to excessive current: Excessive current causes many smaller vessels, country boats in particular, to lose control either partially or completely and eventually cause capsizing. Also large waves and whirlpools make the vessels roll and yaw excessively and lead to complete loss of stability.
- Accident due to physical/mechanical failure: Structural problem such as bottom rupture creates openings to the ship hull and sinks vessels. Faulty navigational systems often lead to grounding and collision. Unwanted objects, such as weeds beneath the water, some times cause damage to the propellers and rudders of smaller boats which eventually cause casualties through capsizing.
- Accident due to other causes (fire, rush of passengers, large waves, etc.): Lack of fire fighting equipments and life saving gears such as lifeboats, life jackets leads to catastrophic accidents. Carrying *excessive* passengers at the upper deck and at places where the design doesn't allow carrying passengers affects

the stability of a vessel severely; thus when passengers rush while embarking and disembarking causes the vessels to list which often affects the stability and causes capsizing. Also modification of designs without the permission of appropriate authority sometimes cause the vessels to possess inherent stability problems which may not seem a big deal of a setback during voyages in calm weather but the affect is observed during overloading and wavy water conditions.

5.0 CONCLUSIONS

The research findings of this study may be summarised in the following manner:

- The *predominant* types of accidents in water ways of Bangladesh are accident due to inclement weather (nor'westers and storms) and accident due to collision.
- Accidents due to inclement weather are more frequent in the monsoon season, although accidents due to *collision* occur all around the year with slightly more tendency towards the winter season.
- Accidents are extremely fatal in comparison to injuries rate and fatality rate of other modes of *transportation*. The average fatality per accident is found to be nineteen per accident and average injury is six per accident.
- Accidents take place almost all around the clock with slightly higher tendency during twelve noon to midnight.
- Most of the accidents and fatalities occur in Barisal, Dhaka and Chittagong divisions.

6.0 RECOMMENDATIONS

Considering the importance of water transportation system in the context of Bangladesh, necessary actions should be taken immediately in order to reduce the number of tragic accidents. This will not only save peoples lives but will also relieve the nation from tremendous amount of economic losses. Recommendations for improvement of waterway safety situation on the basis of this study can be summarized as:

- Weather forecasting system has to be improved to reduce the number of accidents and fatalities in adverse weather. In addition, enforcements may be enhanced to guard plying in a bad weather conditions.

- Loading condition of the all passenger vessel may be checked before any voyage. Legislation regarding overloading can be revised if necessary. Inspection and enforcements may also be enhanced.
- The access to the roof of the vessels should be regulated as during bad weather condition passengers tends to move towards the roof or upper decks of the ship and as a result centre of gravity shifts upwards thus reducing meta-centric height and resulting capsize of ships.
- Collision type of accidents can be reduced by avoiding foggy weather condition ensuring adequate lighting facility and raising awareness of the launch masters. Also the working environment for masters and drivers has to be improved in terms of ergonomics so that they don't get fatigue and/or get reluctant about their responsibility.
- Ensuring appropriate navigational and safety equipments are well functioning for all water transports before leaving a terminal.
- Many of the vessels do not have provision of adequate reserve buoyancy. Therefore proper steps should be taken by the appropriate authority to implement the same.
- The stability of a vessel is the most important criterion to operate it in different loading conditions.
- From the beginning of the construction BIWTA/DOS could pay more attention on the matter.
- DOS/BIWTA may enhance their enforcement facilities and capabilities which may/will eventually ensure that each vessel is plying with properly trained exactly required numbers of crew. Their competence and efficiency could be examined at regular schedule. It has to be strictly ensured that no one except the master navigates a vessel.
- Availability of adequate amount of life saving equipments should be ensured. Crews should be trained in this regard and public awareness should also be increased. Most of the accidents happened during monsoon; therefore, public awareness should be generated both by the launch owners and Government agencies as well for not travelling in bad weather.
- Promote institutional research for in depth analysis of accidents in order to come up with pragmatic solutions. Secure legitimate funding support to carry out and implement research and its recommendations.

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