Characterizing the Driver Behavior for Non-Motorized Transport in Khulna Metropolitan City

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Abstract

Driver behavior has a great effect in controlling the traffic in any country. In today's life, every human is in hurry to reach their destination like home, office, college, shopping mall, restaurants etc. as quickly as possible. To reach their destination quickly people use vehicles on road use and drive them in faster mode, which results in road accidents. Driver behavior is a major cause for the road accidents. It is known to all that most of the people of Khulna city in Bangladesh are having poor livelihood. This lifestyle often leads the poor people to seek for better chances. As non-motorized vehicle driving is a good option for them as it doesn't need any license or better skill to drive and it is also an effective available option for them, the number of drivers as well as non-motorized vehicles are increasing day by day in Khulna metropolitan city area. The main fact is that people of any age having any experience or without experience can drive a non-motorized vehicle. That's why the controlling issue of this vehicles have risen a lot of questions in the mind of the general people as well as traffic controlling authorities. This study focuses on the behavior of drivers having any age in Khulna city, the controlling process of the behavior and to reduce the amount of traffic congestion and accident caused by the uncontrolled behavior of traffic in Khulna metropolitan city. Accidental data was collected at several points in Khulna city and questionnaire survey was also done at several locations among the road users as well as the drivers. From the graphical results representation, it has been seen that 53.2% of accidents were caused by Rickshaw, 30.6% of them were caused by Van and remaining 16.2% of accidents were caused by Wheelbarrow and others. Therefore, some safety measures and long-term recommendations are made to improve the situation of Khulna city.

Keywords: Non-Motorized Vehicles, Driver Behavior, Accidents, Traffic control, Khulna City.

1.0 Introduction

Currently, in tune with economic growth in every county, the numbers of the vehicles increase every year. At the same time, the number of non-expert drivers also increases rapidly. Since most novice drivers are unskilled, unfamiliar with the vehicle conditions and no awareness of traffic rules and regulations, drivers' personal factors have become the main reasons of traffic accidents. For the safety of the vehicle as well as drivers understanding the modeling of human driver behavior, analyzing of those facts and finding out the problems in a systematic way is very much important. Each year more than 500000 people die in road accidents around the world (Mannan and Karim, 1998). To

address this problem, drive behavior analysis need to be developed. As non-motorized vehicle plays a vital role in the transportation media in any country, it is very important to control the behavior of the driver of non-motorized vehicle. It has been often seen than the amount of traffic congestion is increasing day by day with the increase in the numbers of non-motorized vehicles. From the study of National Highway Traffic Safety Administration (NHTSA), it was found that the errors caused by drivers are the major contributor, which is almost 90% of the crashes examined. This report has been conducted to collect various driver behavior analysis. The driver behavior analysis models will give us details about the users driving styles and patterns. It has also been proved that driving in a safe manner is not only accomplished by driving in a relatively error-free manner with taking all the precautions. Intentional violations, mental conditions, having a mind setup for racing and risk taking are some most important factors of road safety as well (Jonah, 1986; Robertson & Baker, 1975; Schuman et al, 1967). Now the term "Non-motorized vehicle" means the vehicles that has no engine system or motor or additional supportive system that can work like a motor or engine, that means the vehicle is fully controlled by the driver himself and the vehicle is operated by physical means of a person such as Rickshaw, Van, and Wheelbarrow, etc. Non-motorized vehicles are slow moving vehicles and for this reason they often caused problems to other vehicles. When non-motorized vehicles are driven in a busy road such as a highway road it has often been seen that for their slow movement through the road, the other speedy vehicles are compelled to reduce the speeds when they are behind the slow-moving vehicles. That often creates traffic jam in almost all on a sudden in the middle of the road. Sometimes it has also been seen that the speedy vehicles have been failed to control their speed and that's why collision with the slow-moving vehicle often occurs which causes sometimes severe accidents. In some cases, loses of life can be seen. So, it is a matter of great concern that the movement of slow moving vehicles have to be controlled. In a developing country like Bangladesh it is a matter of truth that here laws are not followed. Very often, it has been seen that the road users do not maintain the traffic rules. In most of the cases the people are breaking the traffic rules which is also a common phenomenon in Khulna city. The traffic accident situation in Khulna city as well as Bangladesh is now increasing in such a way that none has the security for their own lives and the loss of lives as well as the damages of property are expected to continue if proper precautions are not taken accordingly by applying proper engineering measures as well as making some hard and fast rules through extensive research and investigations. This situation is very dangerous particularly in metropolitan cities. In Khulna city, there are a lot of traffic points but the slow-moving vehicles cannot be seen to maintain any traffic rules. As there is availability of slow moving vehicles everywhere in Khulna city, the number of slow moving

vehicle is increasing day by day. People often choose non-motorized vehicles to save some money and to travel short distance. So, the demand of non-motorized vehicles is also increasing. It has been a matter of great concern that the drivers of non-motorized vehicles need not to issue any kind of license for their vehicles and so people of any age can become driver overnight. As a result, with lack of proper experience the often drive with rush and hurry without following any traffic rules. This often cause hamper in the movement of other vehicles. In Khulna city, there are many branch roads which meets the main road here and there. So, the movement of rickshaw, van etc. in the main road often cause problem to other vehicles. Moreover, they turn here and there which often cause serious accidents. As there are no individual parking place for them in Khulna city the driver of the slow-moving vehicles parks their vehicles here and there and sometimes in the middle of a road which is very dangerous. Sometimes it also has been seen that there is always a hurry in the mind of the drivers of slow moving vehicles and they always want to make race in the road. They always try to overtake the other running vehicles which often cause severe accidents. So, control of the behavior of the driver is a very important issue in this days. In this situation, keeping eye on the above discussion the following objectives are taken for the present investigation.

i) Traffic rules should me made strict.

ii) Proper punishment should be provided for those who break traffic rules

iii) Non- motorized vehicle lane should be constructed separately from main roads.

iv) Drivers should have made aware of their speed limits as well as traffic rules.

2.0 Material and methods

2.1 Locate of study

At present Khulna is the third-largest city in Bangladesh. It is the in the position of the administrative seat of Khulna district and Khulna division. More than 1.4 million people live here. It is one of the old river ports which is located on the Rupsha river. It is an important hub of Bangladeshi industries which hosts many national companies. It is served by Port of Mongla, the second largest seaport in the country. It is in south-western part of Bangladesh at 22°49′0″N 89°33′0″E, on the banks of the Bhairab and Rupsha rivers. It has a total area of 59.57 km² while the district itself is about 4394.46 km². It lies south of Jessore and Narail, East of Satkhira, West of Bagerhat and north of the bay of bengal. It is part of the largest delta in the world. In the southern part of the delta lies the Sundarban, the world's largest mangrove forest. The city of Khulna is situated in the northern part of the Khulna district, and is mainly an expansion of trade centers close to the Bhairab and Rupsha rivers. The western boundary of the metropolitan area is formed by Moyuri river. The number of roads are

1215 nos. Khulna city has a land size of 45.65 km^2 and population density is 26287 per km^2 (KDA, 1999). It has a road network of about 1231 km in metropolitan Khulna of which 302 km is bituminous road, 84 km is Water Bound Macadam (WBM), 81 km is Herring Bone Bond (HBB), 95 km is Flat Brick Soling (FBS) and 669 km is earth road (KDA, 1999). The non-motorized vehicles are the most common means of transport in Khulna. The traffic flows on roadway network of Khulna city are heterogeneous. In many parts of Khulna, rickshaw and other non-motorized transport (NMT) account for 60% or more of the overall traffic flow. The number of vehicles at present operating in Khulna city is almost more than 30000, comprising about 14000 non-motorized and 16000 motorized vehicles (Wikipedia). Now for our research 5 different places at Khulna city were taken. They were:

i) Fulbarigate; ii) Daulatpur; iii) Khalishpur; iv) Boyra; v) Ferighat

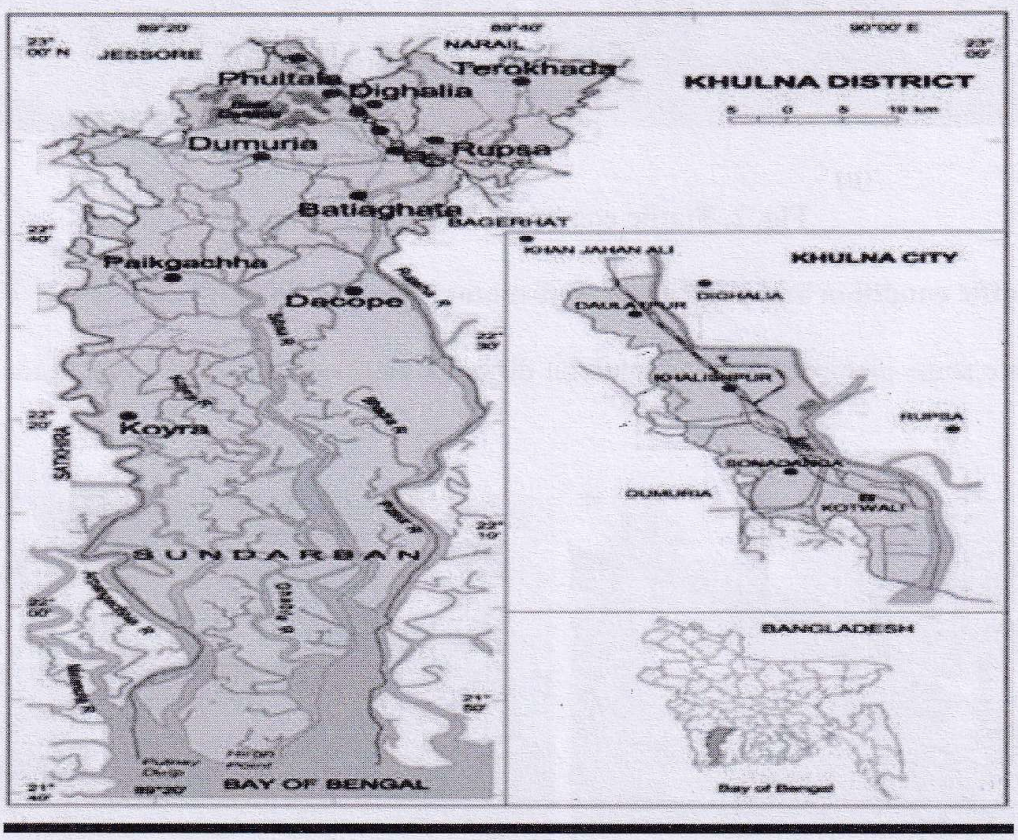


Fig. 1. Map of surveyed areas inside Khulna city.

2.2 Data collection

Field survey was done at different selected points in Khulna city and questionnaire survey was done among the drivers using non-motorized vehicles at randomly selected places in Khulna city. By the questionnaire survey, some important information like the age of the drivers, the percentage of different vehicles moving around the roads and accidental data etc. were known. Some pictures were

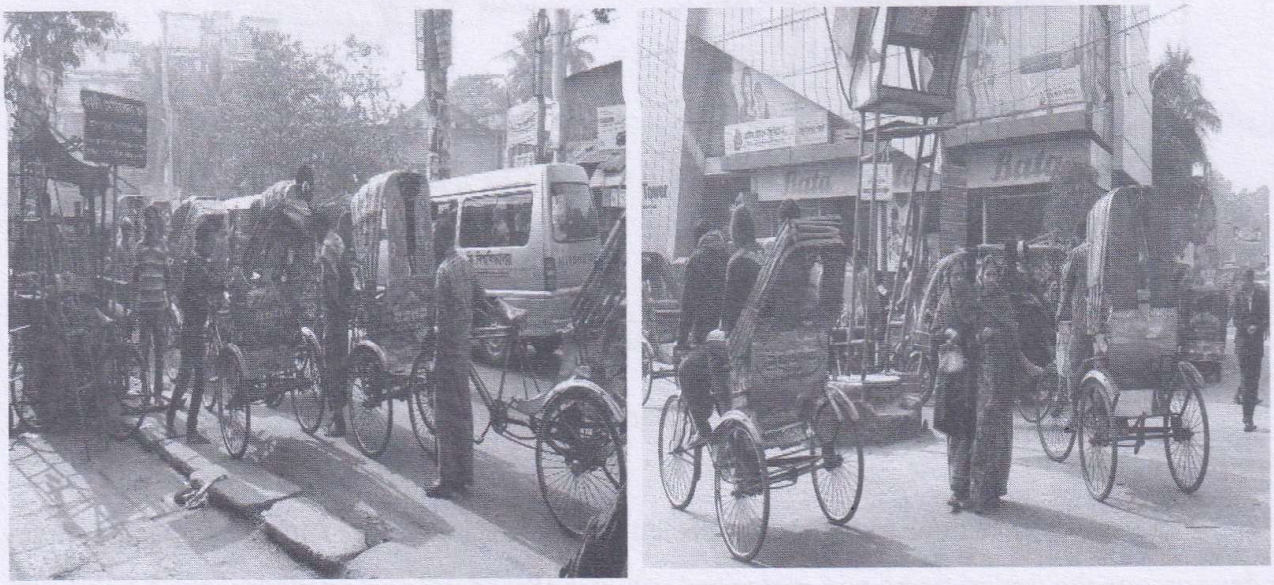
also taken at different points on those surveyed areas showing traffic condition of those areas. All those collected information have been shown in graphical representation.

(a) (b)

Fig. 2. Traffic condition at Fulbarigate.

2.3 Existing traffic condition and practice of Non-motorized vehicles in Khulna city

Here are some pictures taken randomly at different places of surveyed areas inside Khulna City.

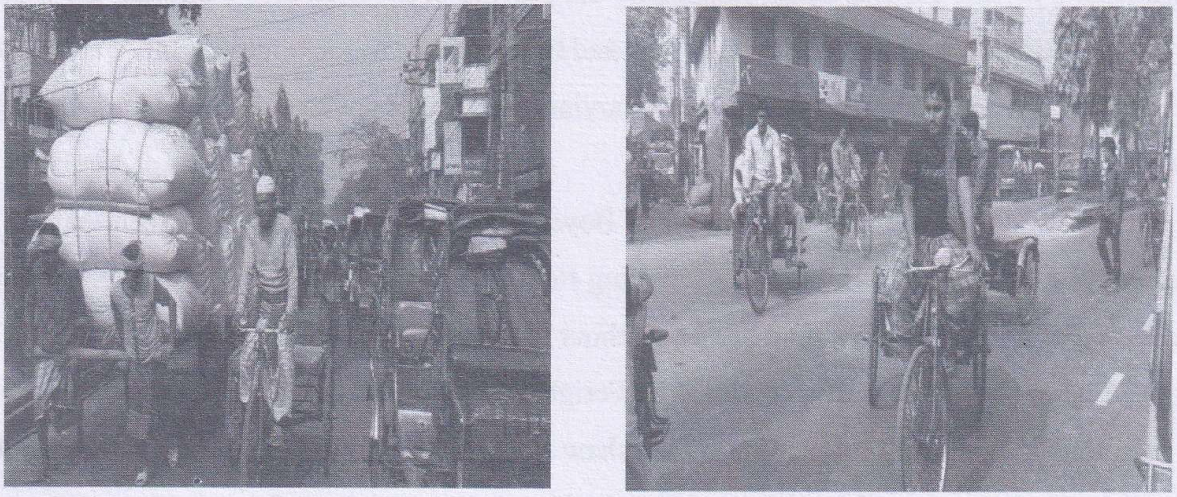


(c) (d)

Fig. 3. Traffic condition at Daulatpur.

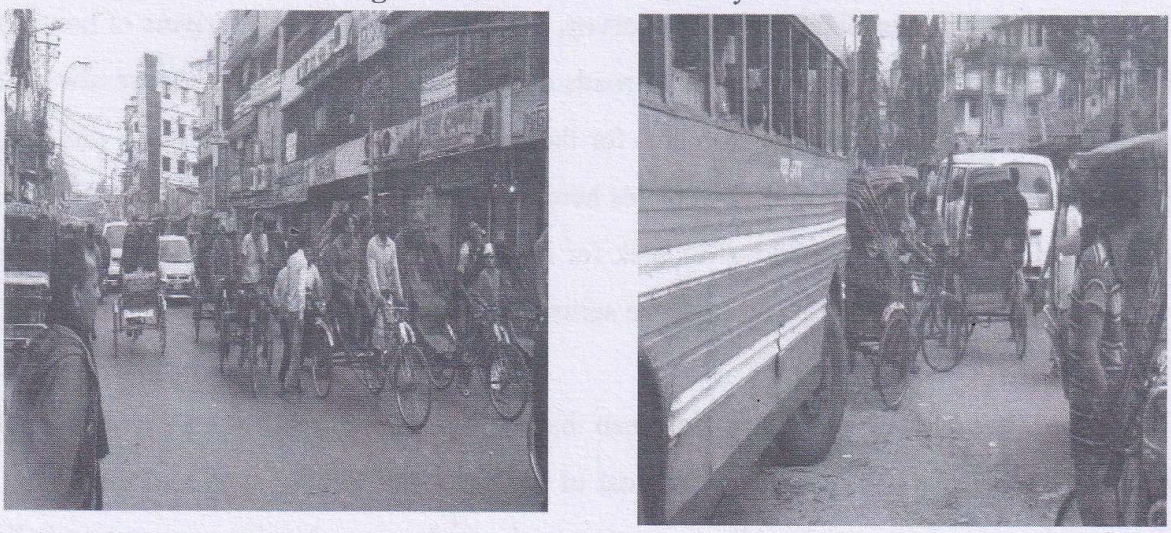
(e) (f)

Fig. 4. Traffic condition at Daulatpur-Khalishpur main road.



(g) (h)

Fig. 5. Traffic condition at Boyra.



(i) (j)

Fig. 6. Traffic condition at Ferighat.

Fig. 2. shows the traffic condition of Fulbarigate. The left fig. (a) shows us that Rickshaws are driven through the footpath which was used by general people. It was looked like the whole footpath was jammed by them. The right fig. (b) shows us that a part of the main road has been blocked totally by van. Those vans were parked here and there, so it created traffic jam in most of the time of the day.

Fig. 3. shows the traffic condition of Daulatpur. In both fig. (c) and fig. (d) it has been seen that traffic jam has been created by unusual driving of non-motorized vehicles. In picture (d) in spite of being a traffic signal post, rickshaw drivers crossed the main road without obeying traffic rules.

Fig. 4. shows the traffic condition of Daulatpur-Khalishpur main road. From Fig. (e) and (f), it has been seen that the regular traffic movement is hampered by the driving of wheelbarrow. Fig. (e) showed that a private car was being stopped by the passing of a wheelbarrow through the main road. Fig. (f) showed that major part of the main road had been blocked by slow movement of a wheelbarrow and beside that wheelbarrow a rickshaw was moving from the opposite direction which shows us the complete breaking of traffic rules.

Fig. 5. shows the traffic condition of Boyra. From fig. (g) it has been seen that the whole main road has been blocked by the slow-moving rickshaw, van and wheelbarrow. Fig. (h) shows us the crossing of a van through a road divider without maintaining any traffic rules.

Fig. 6. shows the traffic condition of Ferighat. In fig. (i) it has been seen that the movement of a local bus is hampered by parking of rickshaw in front of it. In fig. (j) it has been seen that the major portion of a main road had been half blocked by slow movement of rickshaw.

3.0 Results and discussion

From the pictures taken during the survey, it has been seen that the drivers of non-motorized vehicles often create traffic jam in the main roads during the pick hour. As they are always slow in their movement, they often created problems for the motorized vehicles. From those pictures, it also has been seen that they often stop their vehicles here and there without obeying any traffic rules. They often take major portion of a road just to seek for new passengers. In the time of crossing the road, they do not follow any rules. This often cause serious accidents and cause many life losses as well as the loss of properties.

From the field survey, it has been seen that the age of the driver at all over the Khulna city ranges between almost 10 to 65 years. In most of the cases the middle aged and the young people dominate to the rest of the people. All information is shown by a graphical representation in Fig. 7.

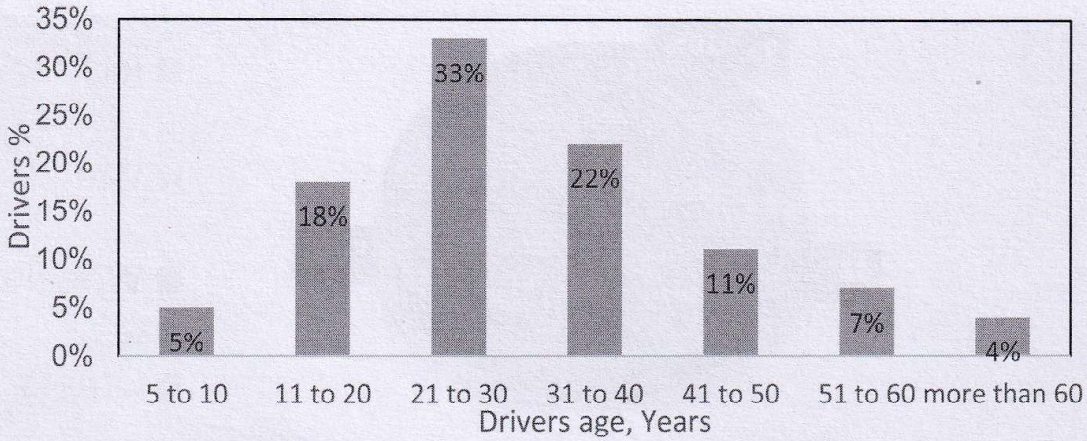


Fig. 7. Graphical representation of age of the drivers.

Because of reckless driving and having no control of the traffic the racing behavior in the mind of the drivers of slow moving vehicles is increasing day by day and that's why the number of injuries and hazardous accidents is increasing. Here are some pie charts showing the accidental contribution of slow moving vehicles at different places of Khulna city.

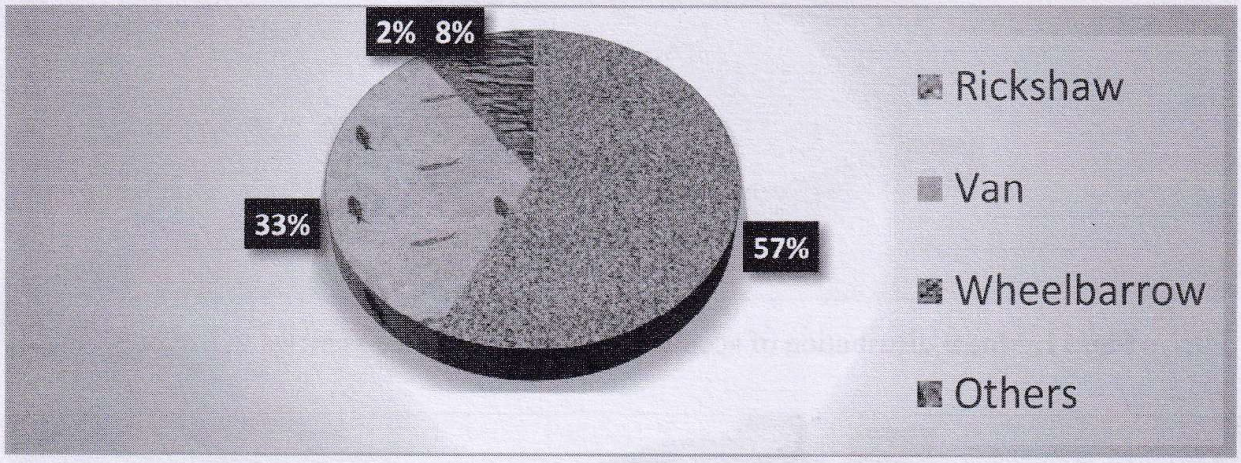


Fig. 8. Modal distribution of accidents by Non-motorized vehicles in Fulbarigate.

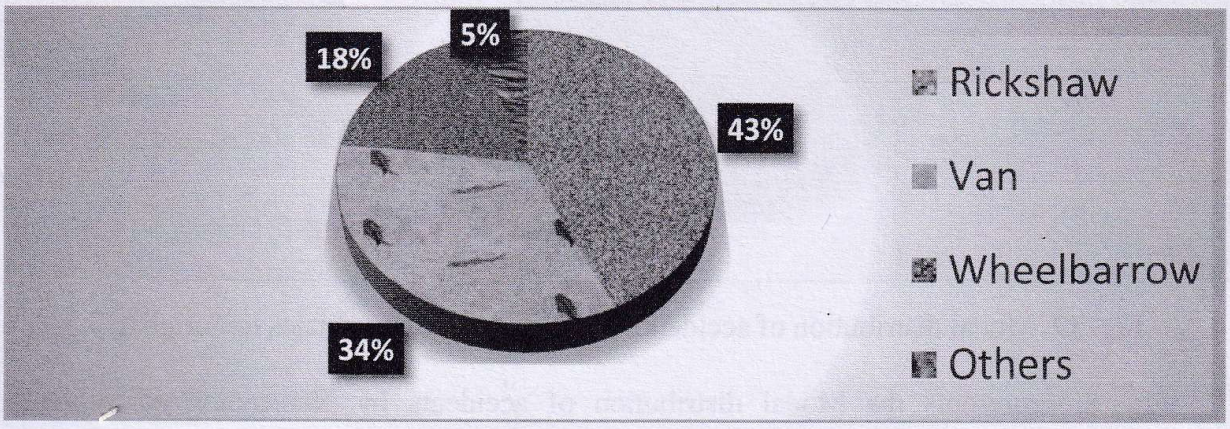


Fig. 9. Modal distribution of accidents by Non-motorized vehicles in Daulatpur.

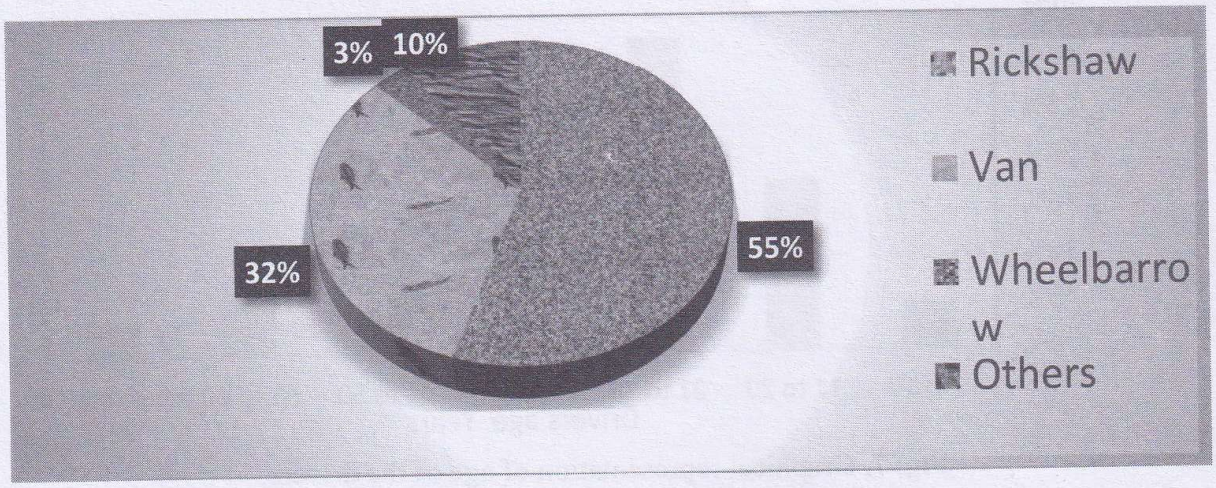


Fig. 10. Modal distribution of accidents by Non-motorized vehicles in Khalishpur.

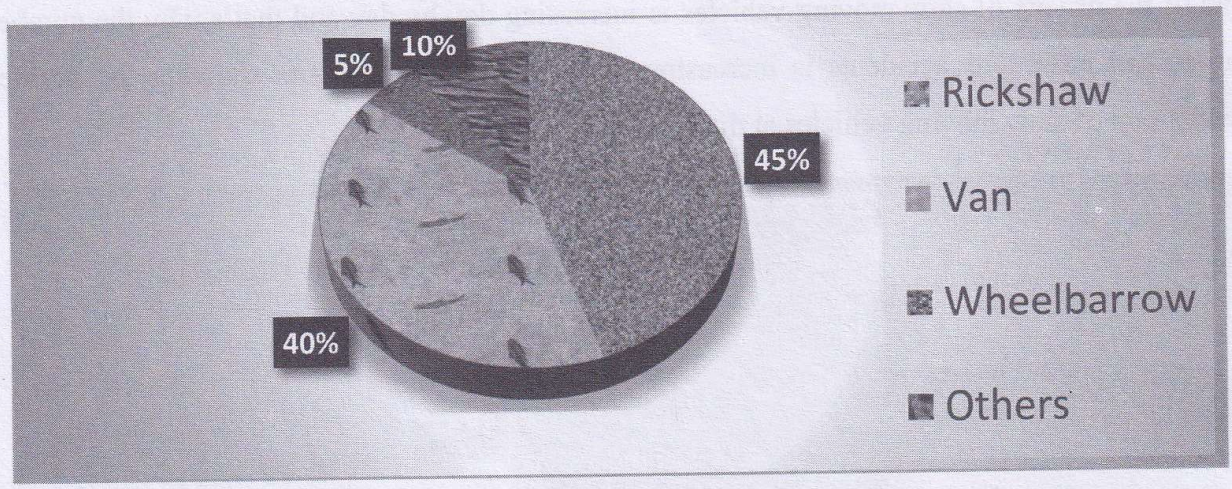


Fig. 11. Modal distribution of accidents by Non-motorized vehicles in Boyra.

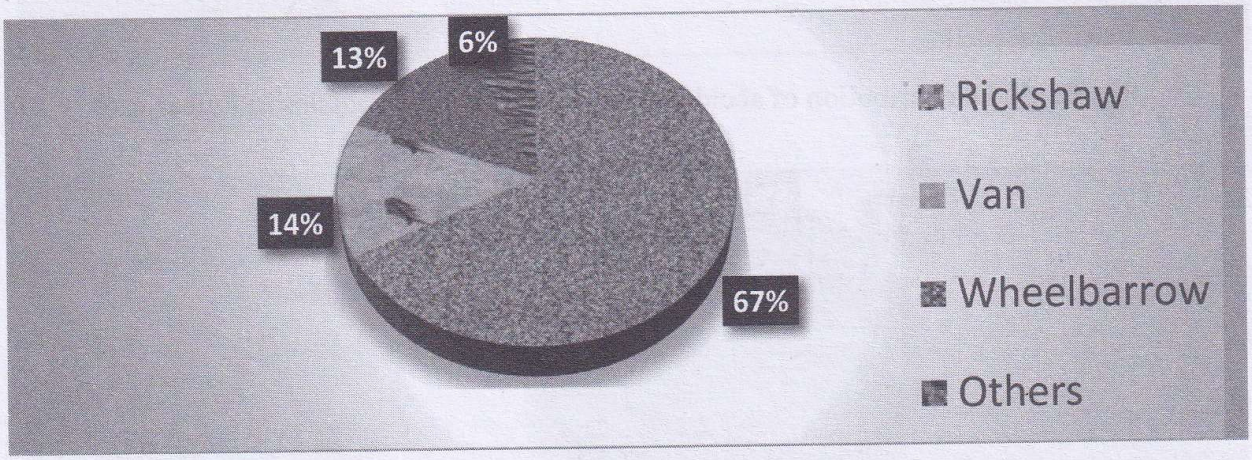


Fig. 12. Modal distribution of accidents by Non-motorized vehicles in Ferighat.

Fig. 8. represents the Modal distribution of accidents by Non-motorized vehicles in Fulbarigate. From the pie chart, it has been seen that 57% of non-motorized vehicular accidents were

caused by rickshaw, 33% of them were caused by vans and the rest were caused by wheelbarrow and others.

Fig. 9. represents the modal distribution of accidents by Non-motorized vehicles in Daulatpur. In this case, most percentage of non-motorized vehicular accidents were also caused by rickshaw, which is almost 43%. On the other hand, 34% of the rest were caused by vans and 18% and 5% of rest accidents were caused by wheelbarrow and others respectively.

Fig. 10. represents the modal distribution of accidents by Non-motorized vehicles in Khalishpur. This case was also dominated by rickshaw accidents which is 55%. Other 32% accidents were caused by vans and rest of 3% and 10% were caused by wheelbarrow and others.

Fig. 11. represents the modal distribution of accidents by Non-motorized vehicles in Boyra. From the chart, it has been seen that major portion of accidents were shared by rickshaw and vans which were 45% and 40% respectively. The rest was shared by wheelbarrow and others.

Fig. 12. represents the modal distribution of accidents by Non-motorized vehicles in Ferighat. Ferighat is the busiest place in entire Khulna city. The pie represents that 67% of non-motorized vehicular accidents were caused in Ferighat only by rickshaw. 14% and 13% of the rest were shared by vans and wheelbarrow respectively. Other causes were 6%.

From those results, it has been seen that most proportions of accidents have been conducted by rickshaw pullers. As the behavior of the rickshaw puller is not at all good in most of the time, they often try to board and unboard passengers here and there that causes traffic jam and most of the time results in accidents. The behavior of van and wheelbarrow drivers are also plays vital role in the case of occurrence of accidents. However, the traffic rules should be more restricted and fines and other effective measures should be taken by the traffic polices so that none can dare to break any traffic rules. Here are some guidelines for safe traffic system that can be very much effective for controlling the traffic of all vehicles.

3.1 Guidelines for safe traffic system design

- Road traffic deaths and serious injuries are preventable, since the risk of incurring injury in a crash is largely predictable and many countermeasures, proven to be effective.
- Make the provision of safe, sustainable and affordable means of travel is a main objective in the planning and design of road traffic systems.
- Preventing pedestrians and cyclists from accessing motorways and preventing motor vehicles from entering pedestrian zones are two well-established measures for minimizing contact between high-speed traffic and unprotected road users.

- Giving priority in the road network to higher occupancy vehicles.
- Road safety is the integral part of road design at planning stage.
- Giving vehicles with many occupant's priority in traffic over those with few occupants is a means of reducing the overall distance travelled by private motorized transport and hence of cutting down on exposure to risk.

3.2 Guidelines for safe planning of road networks

In an efficient road network, exposure to crash risk can be minimized by ensuring that trips are short and routes direct, and that the quickest routes are also the safest routes. Route management techniques can achieve these objectives by decreasing travel times on desired routes, increasing travel times on undesired routes, and re-directing traffic. Some guidelines are given for safe planning:

- Classifying the road network according to their primary road functions;
- Setting appropriate speed limits according to those road functions.
- Improving road layout and design to encourage better use.

3.3 Guidelines for incorporating safety features into road design

- ❖ Higher-speed roads include motorways, expressways and multi-lane, divided highways with limited access. They are designed to allow for higher speeds by providing large radius horizontal and vertical curves, "forgiving" roadsides, entry and exit "grade separated" junctions where there is no contact between motorized and non-motorized traffic and median barriers to separate opposing directions of traffic.
- ❖ Single-lane carriageways in rural areas include many different types of road like: -
- Provision for slow-moving traffic and for vulnerable road users.
- Lanes for overtaking, as well as lanes for vehicles waiting to turn across the path of oncoming traffic.
- Median barriers to prevent overtaking and to eliminate head-on crashes.
- Better highlighting of hazards through road lighting at junctions and roundabouts.
- Improved vertical alignment.
- Advisory speed limits at sharp bends.
- Regular speed-limit signs.
- The systematic removal of roadside hazards – such as trees, utility poles and other solid objects.

- Residential access roads are often designed to achieve very low speeds. Speed limits, usually supported by physical self-enforcing measures to encourage compliance, are normally around 30 km/h, though lower limits are often prescribed.

3.4 Guidelines for Pedestrian and Bicyclist Safety

Although all types of road user are at risk of being injured or killed in a road traffic crash, there are notable differences in fatality rates between different road user groups. In particular, the "vulnerable" road users such as pedestrians and two-wheeler users are at greater risk than vehicle occupants and usually bear the greatest burden of injury. This is especially true in countries like India, because of the greater variety and intensity of traffic mix and the lack of separation from other road users. Some guidelines are given for pedestrian and two-wheeler safety:

- Free left turns must be banned at all signalized junctions. This will give a safe time for pedestrians and bicyclists to cross the road.
- Speed control in urban areas. Maximum speed limits of 50 km/h on arterial roads need to be enforced by police monitoring, and 30 km/h in residential areas and by judicious use of speed breakers, dead end streets and mini roundabouts. In the short term of three years, a target of covering 10% of the roads can be attempted.
- Increasing the conspicuity of bicycles by fixing of reflectors on all sides and wheels and painting them in yellow, white or orange colors.

4.0 Conclusions

From the research, it has been seen that age of most drivers, who are driving non-motorized vehicles in Khulna city lies between 21-40. That is why; sometimes it becomes very tough for themselves to control their mind from sense of racing. From graphical representation, it has also been seen that in average, 53.4% accidents at different places of Khulna city is occurred by rickshaw. Although in recent times the non-motorized vehicles are modified by motors but it is a matter of great concern that the number of non-motorized vehicles are increasing day by day with the increase of population in Khulna city. The number cannot be decreased as the living standard of majority of the people in Khulna city is below poverty line. So as of choice of better livelihood they choose slow moving vehicles. As most of the driver more or less illiterate they don't have any control over their behavior. Strict rules should be made to control their behavior. Besides traffic police have to do their duty with proper concern. They should control the traffic according to proper law. Then the future Khulna city will be a better living place for our next generation.

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