SOME NEW ASPECTS OF MOTORCYCLE CRASHES IN BANGLADESH

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ABSTRACT

The exponential increase in the number of motorcycles, particularly in Asia, is leading to an increase in the frequency of crashes, which is costing significantly in terms of losses caused by subsequent deaths and injuries. In Bangladesh motorcycle crashes are a growing problem resulting from the massive increase of motorcycles. There are over 4 million registered motorcycles in Bangladesh, representing nearly 72 percent of total registered motor vehicles and 15 percent of total reported crashes.

Newspaper-reported 507 motorcycle crashes, that occurred over nine months during July 2022 – March 2023 have been classified using a standard disaggregated event-specific crash classification system known as the Definition of Classifying Accident (DCA) codes. DCA 120 (head-on) is the most common form of motorcycle crash accounting for 31 percent, which is followed by DCA 130 (rear-end) 24.5 percent, DCA 174 (out of control on carriageway) 5.7 percent, and DCA 171 (left off carriageway into object/parked vehicle) 5.5 percent. Around 30 percent of total crashes occur on zilla roads, 27 percent on regional highways, 25 percent on national highways, and the remaining 18 percent of crashes occur on other roads. Young riders in the age group 21-25 have the highest casualty percentage (20%), followed by the 16-20 age group with a casualty percentage of 17.6% and the 26-30 age group with a percentage over 15%. Crashes occur more frequently between the hours of 8 am to 12 am which is around 90% of total crashes. Busses and trucks have the highest involvement in motorcycle crashes, together accounting for almost 61 percent.

Since motorcycles now offer advantages over other modes of transportation in the traffic system, they must be properly incorporated into mobility planning and safety initiatives. This paper discusses some new aspects of recent motorcycle crashes that were published in newspapers to identify common crash characteristics for remedial treatments. Several factors influencing motorcycle casualty risks and some effective road infrastructure, engineering, behavioral, and enforcement measures are also briefly highlighted in this paper.

Keywords: *Bangladesh, motorcycle, crash types, road types, safety countermeasures*

1. INTRODUCTION

With an increasing population (180 million) transport issue in Bangladesh has become a complex issue. The transportation system in this country is predominantly road based with different types of motor vehicles viz. motorcars, jeeps, micro buses, taxis, buses, minibuses, trucks, 3-wheelers, motorcycles and non-motorized vehicles like pedal bicycles, cycle-rickshaws, vans etc. Being a riverine country, road transport plays an important role in catering for the increasing travel demand both for freight and passengers in Bangladesh. Now motorcycles have become a popular mode of transport and people are becoming more interested in motorcycles as an alternative to car travel and public transport for its easy accessibility to reach any destination. The staggering increase in the number of motorcycles (over 4 million) is leading towards a significant increase in the number of crashes and therefore costing enormously in terms of losses occurred by consequent deaths and injuries. This paper discusses the current motorcycle situation, motorcycle crash characteristics, challenges, and opportunities of improving motorcycle safety in Bangladesh.

2. GLOBAL SCENARIO OF MOTORCYCLES AND MOTORCYCLE CRASHES

Among the vehicles that contribute most significantly to traffic crashes is the motorcycle. The significant growth in motorcycling has occurred during the last decades in most parts of the world, resulting in the motorcycles gradually becoming a true mobility tool, attracting an increasingly vast and varied population. According to WHO (2013), 455 million motorcycles were in use worldwide in 2010 which is about 69 motorcycles per 1,000 people whereas around 782 million cars which means 118 cars per 1000 people. Statistics showed that in the period (2002-2010) the rate of increase per 1000 population in motorcycles (from 33 in 2002 to 69 in 2010) has rapidly grown to surpass the rate of car growth (from 91 in 2002 to 118 in 2010). It is perhaps not surprising that most of the world's motorcycles are in Asia (79% of total registered motorcycles in the world) as shown in table 1 and figure 1, given that a very large proportion of the world's population lives there.

Table 1: The overall total motorcycles in the world- 2010

Continent	Registered Motorcycles (2010)	Percentage of total motorcycles (%)	Motorcycles per 1000 population	Percentage of MCs of all vehicles (%)
Asia	359,567,713	78.94	100.80	59.35
Middle East	13,240,634	2.91	28.35	25.21
Europe	38,767,389	8.51	43.90	9.56
Africa	7,938,939	1.74	10.35	22.88
South America	22,801,731	5.01	58.12	22.54
North America	12,395,764	2.72	23.82	3.86
Oceania	778,936	0.17	21.80	4.01
Total	**455,491,106**	100 (%)	World's rate = 68.68	30% of all vehicles

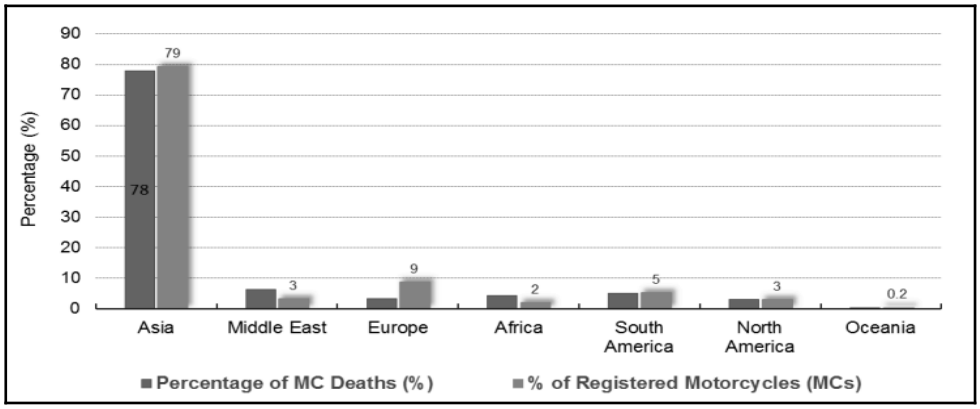

Figure 1: Percentage of motorcycle use and fatalities by continents according to (WHO, 2013)

Most of the world's motorcycles and motorcycle fatalities are in Asia accounting for nearly 80 percent. Six Asian nations (Bangladesh, Cambodia, Lao, Thailand, India, and Myanmar) have motorcycle fatality rates that are higher than the average for Asia (6.5 fatalities per 10,000 motorcycles), with Bangladesh having a rate that is approximately four times higher than both the Asia-wide and global averages (6.5 motorcyclist deaths per 10,000 motorcycles). Figure 2 lists the top ten Asian nations with the highest rates of motorcycle fatalities per 10,000 motorcycles.

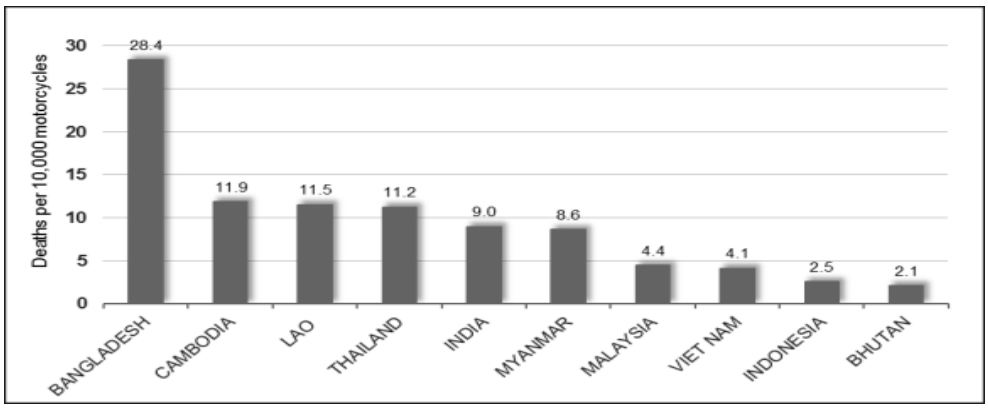

Figure 2: The 10 Asian countries with greatest motorcyclist deaths per 10,000 motorcycles (WHO, 2013)

3. MOTORCYCLE USES AND CRASHES IN BANGLADESH

Bangladesh's transportation system is mostly focused on the road. Table 2 displays the trends in the number of motorbikes registered in Bangladesh along with the overall number of motor vehicles. It can be seen that the number of total vehicles increase from 1427368 to 5592059, which is more than 3.9 times over the period of 2010-2022. The number of motorcycles has increased by 5.3 times over the same period, demonstrating a rapid increase of motorcycles; increased from 52.9% in 2010 to 71.7% in 2022.

Table 2: Number of Total Registered Motor Vehicles and Motorcycles in Bangladesh

Years	Total Vehicles	Total Motorcycles	% of Motorcycles
2010	1427368	755517	52.9
2011	1615404	872051	53.9
2012	1777165	973946	54.8
2013	1913378	1059267	55.4
2014	2073366	1149668	55.4
2015	2381307	1378678	57.9
2016	2779271	1693767	60.9
2017	3198604	2019643	63.1
2018	3693786	2413188	65.3
2019	4191218	2814640	67.2
2020	4568878	3125656	68.4
2021	5013908	3500908	69.8
2022	5592059	4007820	71.7

The social repercussions of traffic crashes include the loss of victim's productivity, the expense of the legal system, the cost of their pain and suffering, and the reduction in the victim's and their family's quality of life. The majority of all social costs are attributable to the loss of productivity. Police reported accident data were gathered from the Bangladesh Road Transport Authority (BRTA) and Accident Research Institute (ARI), BUET. The following section presents some of the conclusions from the analysis of the data on motorcycle crashes. Table 3 lists motorcycle incidents and fatalities alongside those involving other motor vehicles. The number of motorcycle crashes has increased during the past 15 years from 5.6% in 2000 to 15.1% in 2015. Motorcycle fatality rates climbed from 3.8% to 14.4%, nearly four times higher. The risk of death is higher than the chance of injury whenever a motorcyclist is involved in a traffic collision since they are among the most vulnerable road users and are more prone to traffic hazards.

Table 3: Motorcycle Accident Severity by the Year (2000-2015)

Year	All Accident	Motorcycle Accident		All Fatal Accident	Fatal Motorcycle Accident	
		No.	%		No.	%
2000	3970	224	5.6	2523	97	3.8
2001	2925	230	6.9	2029	98	3.8
2002	3741	238	7.2	2599	100	5.0
2003	4114	315	7.7	2769	120	4.9
2004	3566	310	8.2	2509	125	5.0
2005	3322	315	8.3	2424	124	5.1
2006	3549	312	8.5	2668	153	5.7
2007	3910	330	8.7	2989	160	6.2
2008	3662	330	8.8	2723	187	6.9
2009	3852	341	8.9	2789	190	6.8
2010	3974	345	8.9	2860	200	7.0
2011	2017	321	15.9	1566	250	16.0
2012	1939	345	17.8	1515	268	17.7
2013	1755	322	18.3	1421	232	16.3
2014	1585	241	15.2	1269	176	13.8
2015	1692	256	15.1	1337	192	14.4

4. THE RISK OF MOTORCYCLE RIDING

Motorcycles have noticeable characteristics as they are the motor vehicles most exposed to other vehicles and road hazards and therefore the only motorized vulnerable road user group. Motorcycles

are much smaller and lighter than cars, have only two wheels, and do not enclose the rider in a box of metal. These characteristics, along with others, make motorcycle riding riskier than riding in a car. As compared to car crashes, motorcycle crashes are more likely to result in death or serious injury. According to research in the UK, Motorcyclists are more than 50 times more likely to be killed than car drivers, this figure is considered per mile travelled, they are also twice as likely as pedal cyclists, the next most vulnerable vehicle group (streetdirectory.com).
Some of the risks unique to motorcycle riding include (nolo.com):

Less visibility to cars and heavy vehicles: Because motorcycles are smaller and more easily hidden by objects on or off the road, cars are less likely to see them, especially at intersections.
Road infrastructure hazards: Things that have little effect on a car, like debris, uneven road surfaces, small objects, or wet pavement, can cause a motorcycle to crash.
Motorcycles are unprotected and most vulnerable: Unlike passengers in a car, bikers are not protected by a container of metal. Motorcycles also don't have seatbelts, and most don't have airbags (although manufacturers have recently introduced airbags into some models). Wearing a motorcycle helmet can offer some protection to bikers, and motorcyclists who don't wear helmets are more likely to die in an accident than those that do.
Less stability: Vehicles with two wheels are less stable than those with four, especially during emergency braking and swerving.
Skill level and difficulty: Riding a motorcycle requires more skills than driving a car. Unskilled riders account for a disproportionate number of motorcycle crashes. In 2001 in the UK, more than one quarter of all motorcyclists killed in crashes did not have a proper motorcycle license.
High-risk behaviour: Lighter and more powerful motorcycles such as sport and super sport bikes can encourage speeding, fast accelerating, and other high-risk behaviour.

5. ROAD INFRASTRUCTURE ASSESSMENT FOR MOTORCYCLE SAFETY

6. Motorcycle Safety Assessment Results

The International Road Assessment Program (iRAP) - Bangladesh Pilot Project (iRAP 2010) which provided the first comprehensive infrastructure risk assessment of the N2 and N3 highways showed that hazards and deficiencies associated with road infrastructure and roadside environment are major contributors to motorcycle crashes. The safety ratings of these two major highways are mostly (92%) 2-star or less (out of possible 5-star) for motorcyclists - indicative of serious road infrastructure and environmental deficiencies. Further assessment of around 1400 kilo meters of highways revealed that 81% of highway sections are 2-star or less for motorcyclists. The results of both assessments are presented in Table 4.

Table 4: Infrastructure Risk Assessment Results in terms of Star Ratings for Motorcycles

Star Ratings	**N2 and N3 Highways (2010)**		**1372 km National Highways (2013)**	
	Length (km)	Percentage	Length	Percentage
5-Star	1	0%	0	0%
4-Star	17	5%	3	0%
3-Star	8	3%	262	19%
2-Star	194	61%	295	22%
1-Star	99	31%	810	59%
Not rated	0	0%	2	0%
Total	**319**	**100%**	**1372**	**100%**

7. Typical High-Risk Section for Motorcyclists

Figure 3: Typical High-Risk Sections for Motorcyclists: 1-Star Section on R880 Highway (left), 2-Star Section on N5 Highway (right)

Figure 3 illustrates a typical rural roadway section which has poor star rating (1-Star and 2-Star) for motorcyclists indicating a very hazardous condition for motorcycle safety. The characteristics that led to poor motorcycle rating observed in those particular sections of highways are briefly discussed below:

1. There is a significant number of illegal parking along the carriageway within the bazaar and near the junction thus resulting in a congested road network that creates various hazards for vehicles traveling.
2. The presence of street vendors and parked vehicles restricts the use of the shoulder drop off.
3. There are a number of advertising and commercial signs placed along the approach to the bazaar that make the road signs inconspicuous.
4. There are no dedicated sidewalk or crosswalk facilities for pedestrians and absence of regulatory/warning signs or signals.
5. High speed, high occupancy through traffic, mostly commercial vehicles very often have conflicts with local low speed operated minibuses, tempos, and other non-standard vehicles, particularly NMVs.
6. The volume of motorcycle traffic is very high and most of the riders don't use safety helmets which makes them one of the prime vulnerable road user groups.
7. Uncontrolled frequent access and endless linear settlements create hazards along the highways.

8. MOTORCYCLE CRASH CHARACTERISTICS

Newspaper reported motorcycle crash data have been gathered over a period of nine months from July 2022 to March 2023. The trend of motorcycle crashes and casualties illustrated figure 4 in reveals the fatalities and injuries over nine months, with over 60 people dying almost every month as a result of

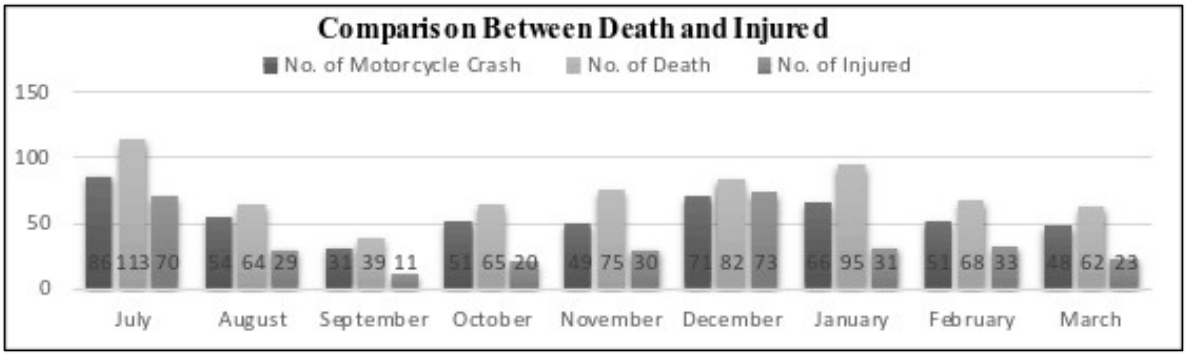

Figure 4: Comparison between Death & Injury due to Motorcycle Crashes in Bangladesh (July 2022-March 2023)

motorcycle crashes and there were only five crashes with zero fatalities. Overall, there were 673 deaths and 320 injuries in 507 motorcycle crashes resulting in 1.33 deaths per crash and 1.96 casualties per crash.

9. Distribution of Motorcycle Crashes by DCA

In order to comprehend motorcycle crash problems and create effective countermeasures, crashes need to be classified according to specific-event collision types and severities. Newspaper-reported motorcycle crashes have been classified using a standard disaggregated event-specific crash classification system known as the Definition of Classifying Accident (DCA) codes. The purpose of a DCA analysis is to identify the root causes of a crash, rather than simply identifying who or what was responsible for the crash. By understanding the underlying factors that led to the crash, it is possible to develop more effective strategies for preventing similar crashes from occurring in the future. Figure 5 describes the codes of classifying crashes.

Table 5 depicts the proportion of motorcycle crash types occurring in Bangladesh between July 2022 and March 2023. The ascendant type of motorcycle crashes is DCA 120 (head-on collision), followed by DCA 130 (rear-end collision). Almost 55% of motorcycle crash types are DCA 120 (31.2%) and DCA 130 (24.4%). The remaining major crash types are DCA 174 (out of control on carriageway) with the percentage of 5.72% and DCA 171 (left of carriageway into object/parked vehicle) with the percentage of 5.52%. And the other crash types are DCA 153 which is cutting in during overtaking, DCA 190 that is fell from vehicle & DCA 100 (run over pedestrian in near side).

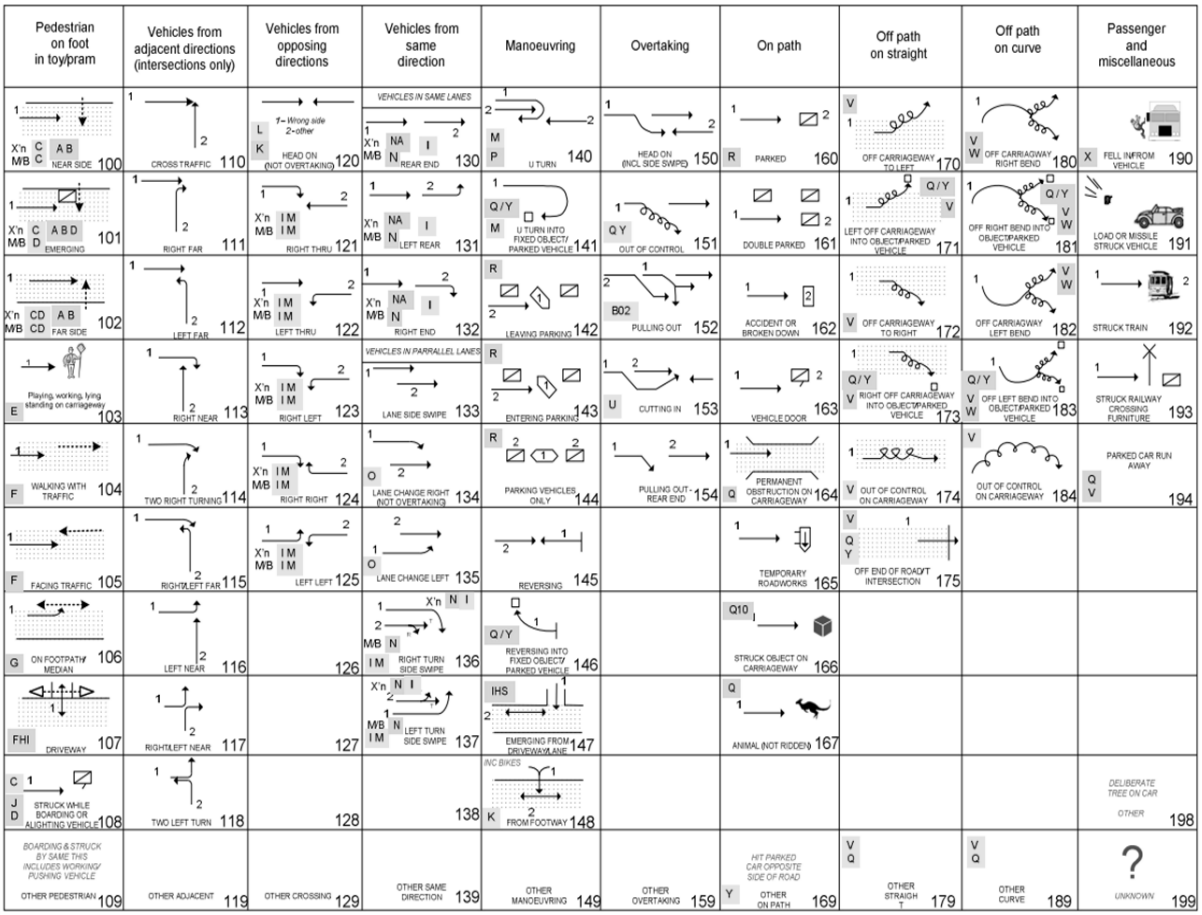

Figure 5: Definition for Classifying Accident (DCA) Chart

Table 5: Motorcycle crashes distribution by DCA (July 2022 - March 2023)

Accident Types	Accident No	Percentage
DCA 120	158	31.16
DCA 130	124	24.47
DCA 174	29	5.72
DCA 171	28	5.52
DCA 153	14	2.76
DCA 190	14	2.76
DCA 100	13	2.56
Others	127	25.05
Total	**507**	**100%**

10. Distribution of Motorcycle Crashes by Age

Distribution of motorcycle crashes among different age groups reveals that 16-40 age groups are the most breakneck group which accounted for nearly 72% of the motorcycle crashes as shown in figure 6. But the young riders in the age group 21-25 have the highest casualty percentage (20%), followed by 16-20 age group with the casualty percentage 17.6% and 26-30 age group with percentage over 15%.

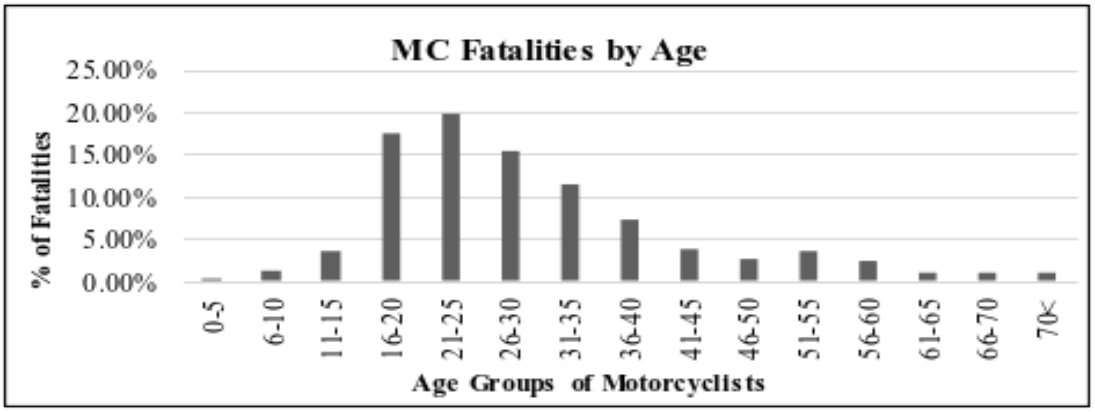

Figure 6: Motorcycle fatalities by age (July 2022- March 2023)

11. Hourly Distribution of Motorcycle Crashe

The daily trend of motorcycle crashes along with all crashes by the hours of a day during July 2022 to March 2023 is exhibited in figure 7. Motorcycle crashes became pinnacle through the period of 12 pm to 2 pm and later at 8 pm to 10 pm. Crashes occur more frequently from 8 am to 12 am which is around 90% of total motorcycle crashes and the remaining 10% crashes occur after midnight.

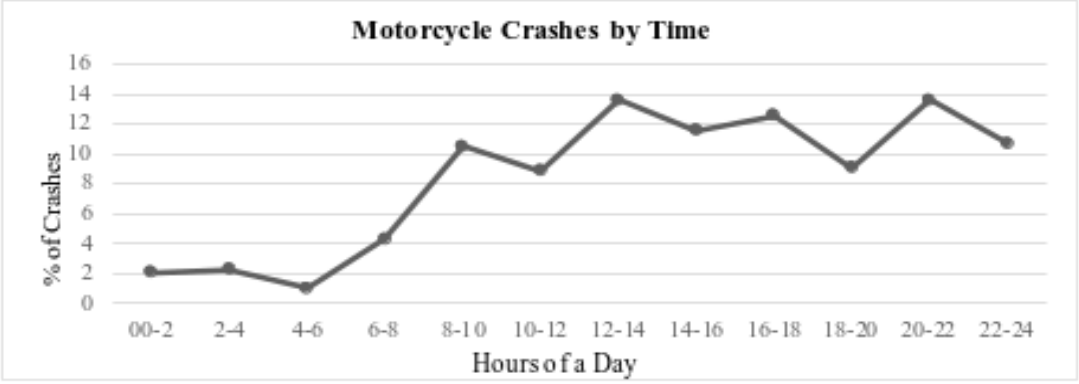

Figure 7: Motorcycle Crashes by Time (July 2022-March 2023)

12. Distribution of Motorcycle Crashes by Vehicle Involvement

Vehicle involvement in motorcycle crashes from July 2022 to March 2023 is illustrated in figure 8 which reveals that the predominant types of vehicles involved in crashes are buses and trucks, which together account for around 61%. And the remaining 39% of motorcycle crashes involved all other vehicles such as motorcycles (7.4%), covered vans (4%), pickups (4.3%), etc.

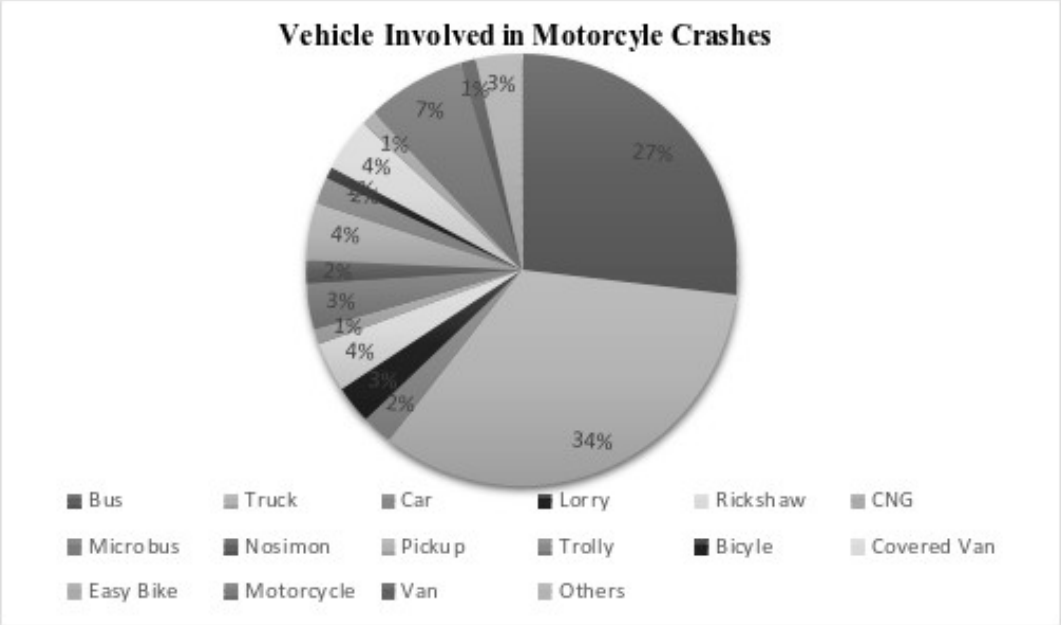

Figure 8: Vehicle Involved in Motorcycle Crashes (July 2022-March 2023)

13.DISTRIBUTION OF MOTORCYCLE CRASHES BY LOCATIONS

Analysis of motorcycle crashes by road class as depicted in figure 9 reveals that around 30% of crashes occurred in zilla roads, 27% in regional highways, 25% in national highways and the remaining 18% crashes occurred in other roads.

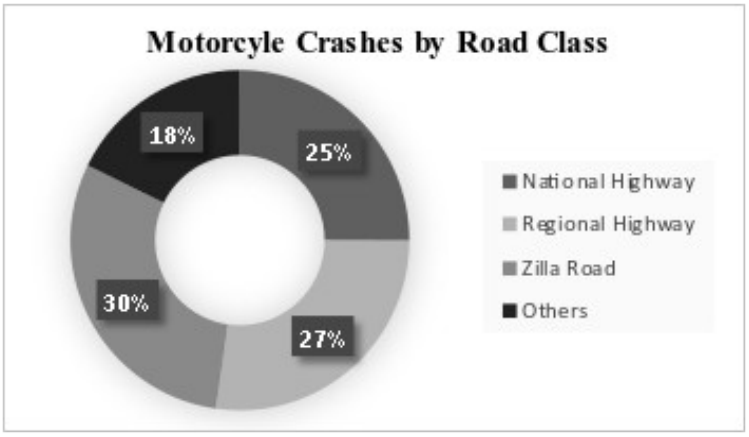

Figure 9: Motorcycle Crashes by Road Class (July 2022-March 2023)

14.A CASE STUDY ON EID-UL-FITR 2023 VACATION

An attempt has been made for in-depth investigation of the motorcycle crashes and casualties during Eid-Ul-Fitr vacation in 2023. According to newspaper reports, there were 73 people were dead and 51 injured in 54 motorcycle crash in Bangladesh in 11 days (19 April 2023-29 April 2023) during Eid-Ul-Fitr vacation resulting 4.9 crashes per day as shown in figure 10. In comparison to regular days, it

appears that the number of motorcycle crashes dramatically increase in the major holidays. Among the deceased, 68 were men, 3 were women and 2 children. 4 pedestrians were killed in crashes.

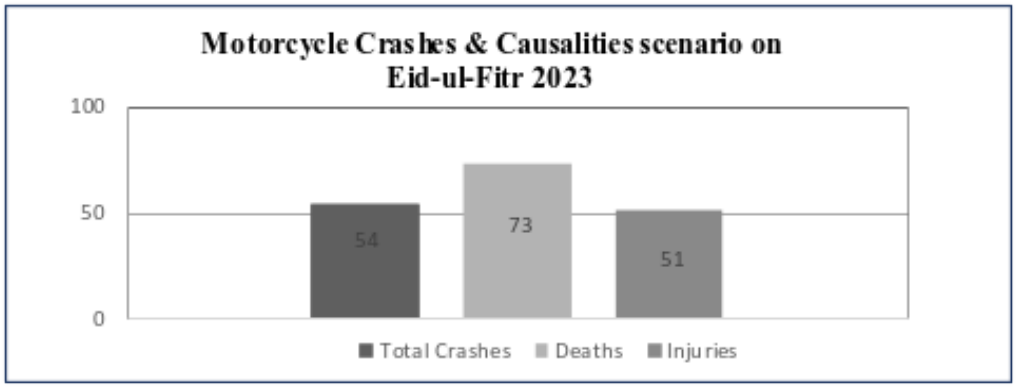

Figure 10: Motorcycle crashes & casualties' scenario on "Eid-Ul-Fitr" 2023 vacation.

15.SAFETY CHALLENGES IN BANGLADESH

The number of road fatalities involving motorcycle is still unacceptably high, addressing the safety of motorcycles and the riders in therefore an enormous challenge. Based on the gathered newspaper reported data of motorcycle crashes, several safety challenges are mentioned below:

- Due to the smaller size and less stable nature of the motorcycle, motorcycles face higher dangers from road hazards like potholes, dead animals, slick pavement collisions, uneven heights between lanes, and other irregularities or unexpected objects in the road, etc.
- Illegal parking and no provision for emergency parking.
- Road marking is either faded away or not visible and no road sign.
- No barrier at medians and footpath.
- Failure to enforce traffic safety laws and regulations.
- Inadequate and unsatisfactory education of road users as pedestrian crossroad abruptly and motorcyclists are unaware of them.
- Excessive and inappropriate behavior of speeding and overtaking by motorcyclists.

16.CONCLUDING COMMENTS

In this descriptive study, we discussed motorcycle crashes and casualties and analyzed the recent crashes which were published in newspapers to develop common crash characteristics between the crashes. Also stated several factors influencing motorcycle casualty risks and some effective road infrastructure, engineering, behavioral and enforcement measures are briefly highlighted. In this study, it seemed that the ascendant type of motorcycle crash was DCA 120 is the most common form of motorcycle crash accounting for 31 percent, which is followed by DCA 130 (24.5%), DCA 174 (5.7%), and DCA 171 (5.5%). Young riders in the age group 21-25 have the highest casualty percentage (20%), followed by the 16-20 age group with a casualty percentage of 17.6% and the 26-30 age group with a percentage over 15%. Crashes occur more frequently between the hours of 8 am to 12 am which is around 90% of total crashes. Busses and trucks have the highest involvement in motorcycle crashes, together accounting for almost 61 percent. Around 30% of crashes occur on zilla roads and 27% on regional highways. The severity of motorcycle crashes in Bangladesh is higher during the major religious festival vacation. The distribution of crash types during Eid-Ul-Fitr 2023 vacation (11 days) was similar to regular days. In Bangladesh motorcycle crashes are a growing problem resulting from the massive increase of motorcycles. There are over 4 million registered motorcycles in Bangladesh, representing nearly 72% of total registered motor vehicles. Motorcycle crashes are caused by a variety of variables, but road infrastructure risks predominate. Motorcycle crashes cannot be avoided until safety features are embedded into the road infrastructure, which is a priority issue for engineering safety on roadways. This study revolves around introducing new

perspectives or insights into motorcycle crash characteristics. Its novelty might stem from uncovering previously unexplored factors contributing to crashes, perhaps focusing on emerging trends, specific environmental or behavioural elements, or innovative approaches to analysing crash data. This study has also some potential limitations. Firstly, newspaper reports about motorcycle crashes sometimes lack information, making it difficult to classify them accurately. Secondly, not all motorcycle crashes in Bangladesh are published in newspapers, so not all crashes fall under the classification. Future studies can concentrate on collecting and analysing comprehensive collision data, which may include elements like rider behaviour, road conditions, vehicle features, and injury patterns, to determine specific safety initiatives and identify important risk factors.

17.RECOMMENDATIONS

For motorcycle safety improvements, a series of remedial measures needed by the combination of engineering, enforcement and behavioral measures. If the following recommendations are taken into consideration, the government will be able to reduce the number of cases to the barest minimum based on the summary of the findings stated above regarding the number of road crashes.

Measures Relating to Road Infrastructure and Environment

- The irregularities of the surface should be removed, and potholes should be repaired properly because of being two wheelers, motorcyclists are more susceptible to difficulties and hazards created by the roadway conditions.
- Exclusive or inclusive lane for motorcycles needs to provide to prevent interaction among motorcycles, non-motorized vehicle, passenger private car, bus, truck, and other heavy vehicles.
- Proper road traffic signs and markings should be installed, and they should be retro reflective and visible from extremely far by the motorcyclists. Medians should be repaired at the broken places.
- Pedestrian crossing facilities need to be provided like zebra crossing, foot over bridge.
- Treatments of roadway shoulders (provide wider and stronger shoulders and recovery area).
- Focus on expanding the existing road network in both urban and rural areas to accommodate increasing traffic and improve connectivity. Additionally, prioritize regular maintenance to ensure the durability and safety of roads.

Measures Relating to Vehicle and Transport System

- Ensure safer vehicle standards for road worthiness as well as for crash worthiness.
- Installation of Intelligent Transport Systems and other collision avoidance/ modern safety devices for assisting and controlling drivers.
- Promotion of measures to increase motorcycle conspicuity such as daytime running lights, motorcycle colors, including fluorescence or modifications and rider clothing.

Enforcement, Behavioral and Institutional Measures

- Effective enforcement of laws and sanctions against alcohol/drugs, impaired drivers, and motivation of attitudes of drivers towards safer vehicle operations, and vehicle maintenance.
- To avoid crashes the motorcyclist should drive at moderate speed. There should be less overtaking, and it should be done very carefully.
- Motorcyclists should be self-aware of wearing helmets and not talking over the phone or not talking with pillion passengers while driving.
- Developing and implementing community-based road safety programs frequently.
- To ensure the obedience of riders to traffic rules and regulations and create public awareness on road safety.
- Implement institute training policy before motorcyclists are issued with a road license. That is, motorcyclists should possess a road license after attending a motorcycle training course from a reliable institution.
- Encourage collaboration between government agencies, non-governmental organizations, and motorcycle manufacturers. Foster partnerships to develop and implement safety initiatives, share best practices, and conduct research on motorcycle safety.

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