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Comparison Analysis and Study of Accident Blackspots between Two Years of Highway

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Abstract: In this study, the analysis of the accident conditions on Yangon-Bago Highway Road during 2010 and 2018 are compared and the accident blackspots along this highway are identified with frequency method and Severity Index Method. The gender percentage involved in accidents, accident types, accident frequency, time of accident, types of vehiclesinvolved in accident, causes of accident, priority values and severity index values are analyzed in detail for identifying the hazardous zones or blackspots of this highway.Traffic accidents are unavoidable and unexpectable matter in human life and so highway safety is an important role in transportation engineering. Nowadays, road traffic accidents lead the social problems such as causes of fatality, disabilities and loss of property. There are many other factors which contribute directly or indirectly to the accidents. The identification of blackspots or hazardous locations of road traffic accidents is an important role for improving the highway safety. Road safety becomes an essential tool in the world due to its climbing to higher ranks in the causes of death annually. In this study, it is observed that 3 blackspots in 2010 and 14 blackspots in 2018. Knowing blackspots or high hazardous zones can help in reducing the road accidents and increasing the safety for all road users travelling on this road.

Keywords: Traffic Accidents, Blackspots, Hazardous Zones, Safety.

1. INTRODUCTION

Transportation belongs to one of the most important aspects of human society. It plays a vital role in the developments of a country. It is essential in economic, social, communication, education, industrial, health and cultural development of country. A safe and efficient transportation system is required to provide regional and national economy. It is also useful for travelling of people and being carried of goods and things. For equitable development of various regions in Myanmar, the government is constructing a road network throughout the country. With difficult road transport, the people once had to love as if they have been far away from each other. At present, the whole nation has seen a network of roads and bridges. All corners of the Union are now easily reachable. A smooth and safe transportation system brings about in saving times and cost and also gives reliable, comfortable, convenient emotion and safety for people. Traditionally, road crashes have also been seen as an unfortunate consequence of a transport system and as a problem for the transport sector. However, the direct costs of the growing number of crashes falls mostly on the health sector, businesses and families.

Today, it is widely acknowledged that many sectors have a role to play in road safety, especially in the prevention of crashes, deaths and injuries. Nowadays, the road safety management is an essential and important factor in consideration for the road safety. It has the aims of saving human life and reducing the number of people being killed or injured due to the road-traffic accidents. It is a scheme for improving traffic flow, reducing accidents on motorways, relieving driving stress and providing reliable journey times and also makes use of automobile systems and human intervention to manage traffic flow and ensures the safety of road users. For the safety aspect, not only geometric design and pavement engineering but also traffic engineering have to be considered.

The development of the economy in a country depends on transportation system of that country. Moreover, in a country, administration, management, security and society mainly depends on transportation system. A good transportation causes an improvement of regional economy. Transportation is the most important facility for moving people and materials. It contributes to the economic, industrial, social and cultural development of a region or a nation. In order to become a developed countries, Myanmar needs to reduce the rate of road traffic accidents and to maximize the road safety level for all road users. And so, road accident data analysis should be carried out to know the high hazardous locations or zones for improving measures and road characteristic performances.

2. LITERATURE REVIEW

Traffic accidents are one of the major causes of violent death in the world. Many people die or injure because of traffic accidents in everyday and its cost is too high. In order to decrease the rate of traffic accident, traffic accident analysis should be carried out to determine which section of a road is a faulty in other words hazardous location. Traffic accidents are rare and unavoidable. Many people died or injured due to traffic accidents all over the world. Many reasons can contribute these results which are mainly of driver fault, lack of infrastructure, environment, weather conditions, poor geometric design etc. First, the three major components of highway safety are driver behavior, vehicle safety, and roadway safety. Roadway safety refers to that portion of overall highway safety that is determined by the roadway's physical features such as road design, roadway signs, pavement markings, operating conditions, roadside objects (such as utility poles, signs, trees, guardrails), bridges, and intersections. The personal and economic costs of highway crashes to our citizens and communities are enormous.

The causes of accidents, the time of accident occurance, the involvement of vehicles, the involvement of number of persons, finding of hazardous locations are described in this study. Multidisciplinary research has shown that traffic crashes are caused by three factors such that often interact complex way to trigger the initiation of the event. Among the several causes of traffic accidents, it can be mentioned the poor condition of the roads, the poor condition of some vehicles, the inexpertness of some drivers, distraction, etc. Accurate accident analysis is largely dependent on through knowledge of the characteristics of drivers, vehicles and roadways and their interrelationships and upon accurate accident reports. Highway and street accidents can be studied as four categories: (1) single vehicle, (2) multiple vehicles, (3) vehicle-pedestrian, and (4) vehicle-fixed objects. The distribution and types of accident varies greatly.

With the increase in motorization, road traffic accidents are happening more frequently in developing countries. The number of people killed in road traffic crashes each year is estimated at most 1.2 million all over the world. Today, with the increase significantly in number of vehicles, the number of road traffic accidents are more occurring. In order to prevent traffic accidents and economic losses for road users, road traffic analysis becomes essential and important role. Knowing the hazardous locations can help for improving the safety of highway.

3. METHODOLOGY

3.1. Study Area

. Two major cities of Yangon and Bago are connected with this highway and it is considered as study area in this paper. It is also a main highway that links Upper Myanmar and Lower Myanmar of our country. The more traffic flow on this highway, the more road traffic accidents happens. The accident analysis and the identification of hazardous zones or accident blackspots on this highway should be studied to reduce accident rate and to upgrade the highway performances and safety. The road traffic accident data during 2010 and 2018 (two nonconsecutive years) and the section length of this highway (32 miles 6 furlongs) are studied to analyze in this study.

Fig 1. Location Map of Study Area

3.2. Data Collection

The accident data in Yangon-Bago Highway Road during two nonconsecutive years of 2010 and 2018 are collected from Myanmar Police Force. These accident record data are collected from five police stations which are Bago No.1. No.2, No.3, Indakaw and Hlegue Police Stations. The traffic volume data between 2010 and 2018 are also collected from two toll gates such as Htauk Kyant and Bago toll gates.

3.3. Methods of Analysis

This study aims to analyze the accident of the highway at the hazardous places with the use of frequency method and Severity Index Method to find high hazardous zones on Yangon-Bago Highway to identify the high hazardous locations for improving the safety. After the high hazardous zones or accident black spots are known from accident analysis, suitable remedial countermeasures for this zones can be given to decrease highway accident rate and to improve highway safety. The growth factor between 2010 and 2018 are also observed with Linear Growth formula.

4. RESULTS AND DISCUSSION

4.1. Road Condition and Traffic Volume Condition

The road condition between 2010 and 2018 are significantly not changed and the followings are the road condition of Yangon-Bago highway road.

Design year = 40 years
Allowable Design speed = 30 mph (48 kmph) within city boundaries and 50 mph (80 kmph) in outside city limits
Right-of-way = 100 ft
Number of traffic lanes = 6 lanes (3 lanes in one direction)
Width of travelled lane = 12 ft
Width of pavement = 72 ft
Width of shoulder = 6 ft
Width of median = 8 ft
Type of pavement = Bituminous road

The traffic volume conditions of this highway between 2010 and 2018 are collected from Htauk Kyant Toll and Bago Toll.

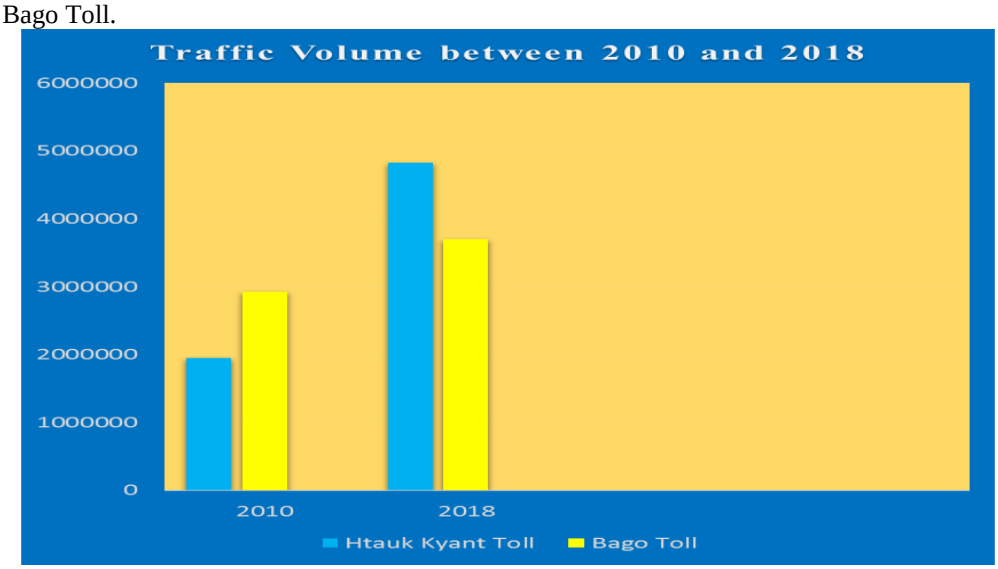

Fig 2. Traffic Volume between Htauk Kyant Toll and Bago Toll during 2010 and 2018

It is observed that the traffic volume are significantly increased at Htauk Kyant Toll during 2018 than during2010 and traffic volume at Bago Toll during 2018 are also increased than during 2010.

4.2. Growth Factor and Growth Rate of Traffic Volume between 2010 and 2018

The growth factor of traffic volume are calculated by Linear Growth formula to know the traffic volume development rate between two different years of the same highway. The traffic volume conditions between two toll gates located on this highway are described in figure 2. Linear Growth increase in traffic

volumes over time. This method assumes a constant amount of growth in each year and does not consider a capacity restraint.

Future Volume = GF x Base Year Volume (1)

Where:
GF = Growth Factor = 1 + (G x N) (2)
G = Linear annual growth rate, expressed as a decimal
N = Years beyond the base year

In this study, the forecast 8-year traffic volumes are developed based on historical counts. The traffic volume data between two toll gates that are located on this highway are described in figure 2. Based on these data, the 8-year growth factor would be 1.749. Assuming linear growth in the future, the annual growth rate would be (1.749–1.0) /8 = 0.0936, or 9.36%.

4.3. Accident Analysis

The accident data on Yangon-Bago Highway Road during 2010 and 2018 are collected from Myanmar Police Force. These data are analyzed to know accident types, accident frequency, time of accident, types of vehicles involved in accident, causes of accident. In this study, 32 miles 6 furlongs of Yangon-Bago highway is considered and studied as study area.

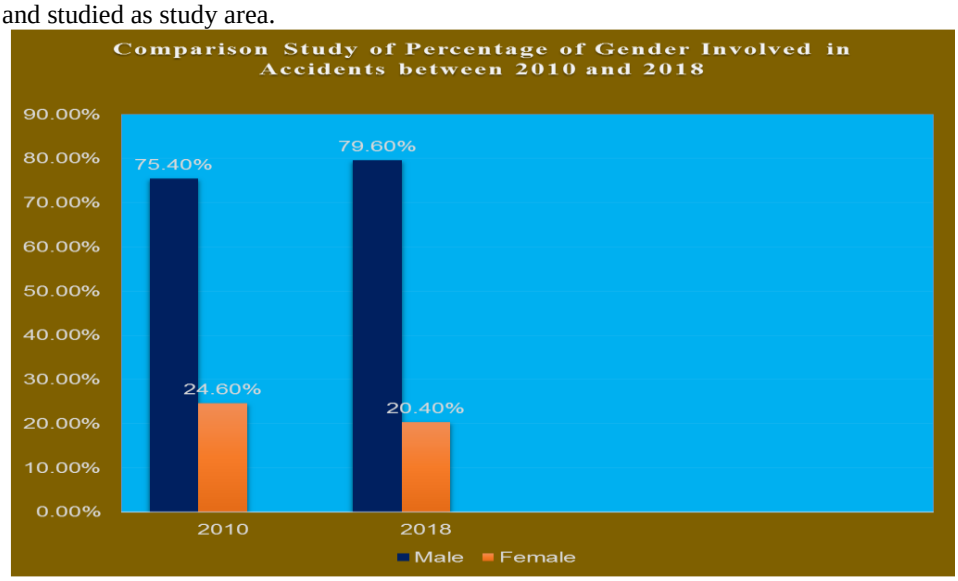

Fig 3. Comparison of Gender Involvement in Accidents

The above Fig 3 shows the male and female involvement in accidents of Yangon-Bago highway during 2010 and 2018. It is found that the males are more suffered from road traffic accidents than females in both years.

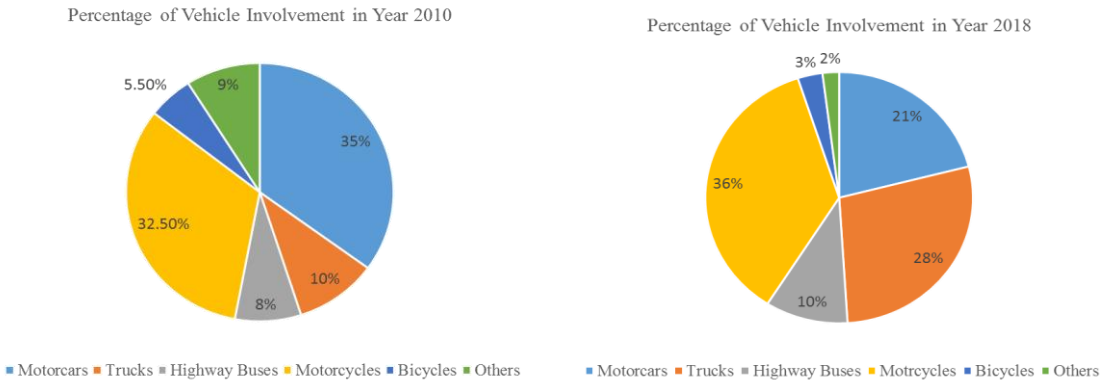

Fig 4. Frequency Distributionof Vehicle Typein Accidentsduring 2010 and 2018

In above Fig 4, the involvement percentage of motorcars in accidents with 35% is the highest during 2010 and after 8 years of 2010, motorcycles with 36% is the highest in 2018. This is the factor of most of the local people use motorcycles more and more year by year and they have no or less safety knowledge and they do not usually wear helmet for safety.

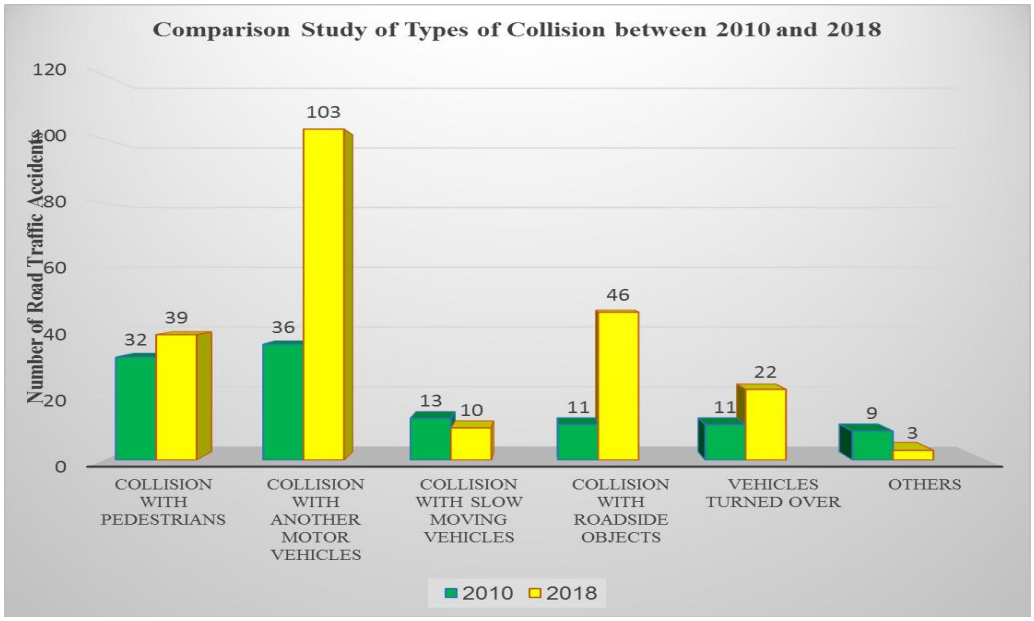

Fig 5. Frequency Distribution of Vehicle Type in Accidents during 2010 and 2018

In above Fig5, it is found that the collision with another motor vehicles with number of 36 in 2010 and number of 103 in 2018 is the highest. This is due to the high speed, careless overtaking, careless turning and the less traffic related sense of drivers.

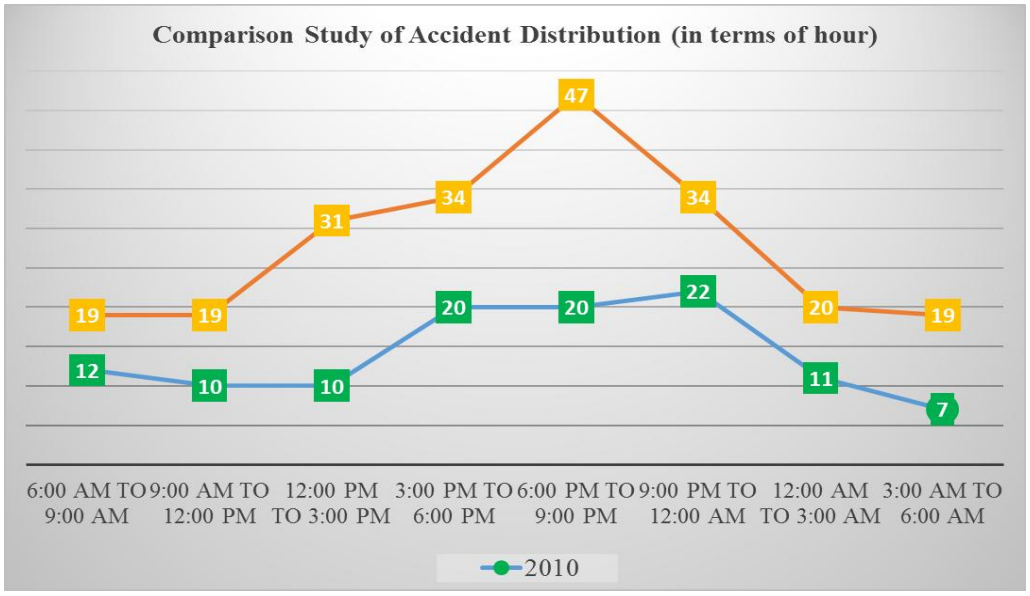

Fig 6.Comparison of Accident during 2010 and 2018 (in terms of hour)

Through the above Fig6, the factor of the accident occurred during the night with nearly 54% is more than accident occurred during the day with 46% is identically observed in both 2010 and 2018. This is due to the fact of drinking alcohol by drivers, high speed, drowsiness and the weakness of highway lighting at nighttime.

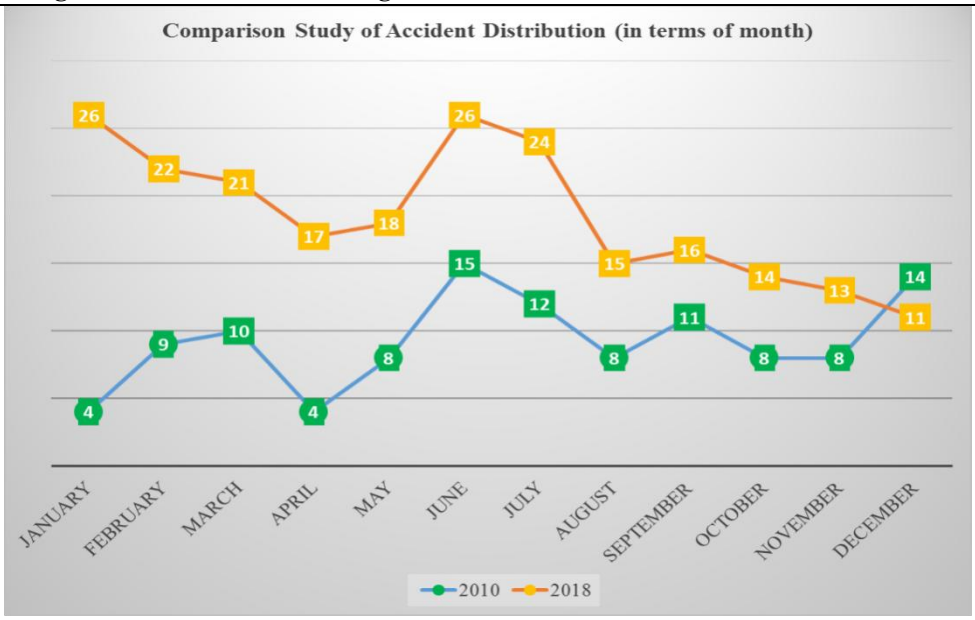

Fig 7. Accident Distribution during 2010 and 2018 (in terms of month)

The above Fig7 shows June with 13.39% became the black month for road accidents during 2010 and January and April were less in the number of road accidents, deaths and injuries than other months. In 2018, it is found that January and June with 11.66% was the most accident occurring months and also December with 4.93% was the least.

TABLE 1. Results of Priority Values

Zone No. (Z)	Miles		P Value (Year 2010)	P Value (Year 2018)
	From	To		
1	1	1.5	0	23
2	1.5	2	0	3
3	2	2.5	7	0
4	2.5	3	14	13
5	3	3.5	0	8
6	3.5	4	11	5
7	4	4.5	0	17
8	4.5	5	2	1
9	5	5.5	5	3
10	5.5	6	7	0
11	6	6.5	5	4
12	6.5	7	8	22
13	7	7.5	13	0
14	7.5	8	9	0
15	8	8.5	8	0
16	8.5	9	0	8
17	9	9.5	5	8
18	9.5	10	0	0

19	10	10.5	0	0
20	10.5	11	3	8
21	11	11.5	9	10
22	11.5	12	1	0
23	12	12.5	0	0
24	12.5	13	8	5
25	13	13.5	3	6
26	13.5	14	2	0
27	14	14.75	5	14
Mile Post changes suddenly from 14 Miles 6 Furlongs to 31 Mile due to No.2 Main Road comes in this intersection (ZaYatKwin Intersection)				
28	31	31.5	0	3
29	31.5	32	3	11
30	32	32.5	0	5
31	32.5	33	6	8
32	33	33.5	4	3
33	33.5	34	1	53
34	34	34.5	1	14
35	34.5	35	0	3
36	35	35.5	1	14
37	35.5	36	4	31
38	36	36.5	1	26
39	36.5	37	0	3
40	37	37.5	5	10
41	37.5	38	8	3
42	38	38.5	0	6
43	38.5	39	0	3
44	39	39.5	8	3
45	39.5	40	0	0
46	40	40.5	0	4
47	40.5	41	1	3
48	41	41.5	10	5
49	41.5	42	0	3
50	42	42.5	0	1
51	42.5	43	6	17
52	43	43.5	10	10
53	43.5	44	2	6
54	44	44.5	0	21
55	44.5	45	12	12
56	45	45.5	6	22
57	45.5	46	3	11
58	46	46.5	0	5

59	46.5	47	3	7
60	47	47.5	4	31
61	47.5	48	0	24
62	48	48.5	11	20
63	48.5	49	18	26
64	49	49.5	23	22
65	49.5	50	20	13

The above Table 1 shows the priority values of each zone during 2010 and 2018. Yangon-Bago highway road is studied as 0.5 miles interval as each zones. There are 66 zones on this highway and mile post changes suddenly from 14.75 miles to 31 miles between zone 27 and 28. This is because of the addition of the length of No.2 Main Road. Based on the Severity Index Method, the priority values of zones are calculated. If the priority value is above 15, this zones can be classified as high hazardous zone or black spot of highway. Through this table, Zone 63, 64 and 65 should be considered as high hazardous zones or during 2010. Moreover, Zone 1, 7, 12, 33, 37, 38, 51, 54, 56, 60, 61, 62, 63 and 64 are also considered as high hazardous zones or during 2018 since they have priority values are greater than 15. The number of hazardous zones in 2018 are significantly more than 2010. This is the primary factor of increase in motorization on the highway year by year can cause the road accidents more and more. Therefore, the number of hazardous zones in 2018 are more than in 2010.

4.4. Accident Severity Index of Yangon-Bago Highway during 2010 and 2018

The accident severity index measures the number of deaths per accident. The accident severity index on Yangon-Bago highway road during 2010 and 2018 is calculated as follows and the results are shown in following Table 2.

$$\text{Severity Index, SI} = \frac{the\ number\ \ of\ \ fatalities}{the\ number\ \ \ of\ \ accidents} \quad (3)$$

The following Table 2 shows the two severity index values between 2010 and 2018. Although the number of accident in 2010 is decreased than in 2018, but the fatality rates in 2010 are increased than 2018. Therefore, it is found that the severity index value in 2010 is greater than in 2018.

TABLE2. Comparison of Severity Index Values between 2010 and 2018

Severity index Value	
Year 2010	Year 2018
0.232	0.179

5. CONCLUSION

In this paper, hazardous zones or locations of Yangon-Bago Highway during 2010 and 2018 are investigated and compared by frequency method and Severity Index Method. Accident data are analyzed by vehicles, time (in terms of hour and month), types of collision of vehicles, age group of persons involved in accidents and priority index. It is found that there are only 3 hazardous zones during 2010 and 14 hazardous zones in Yangon-Bago Highway during 2018.

From this analysis, the following conclusions are drawn:

1. Since the increase in motorization, the number of traffic accidents are increasing according upon on it year by year and more occurring accident blackspots.
2. This study found that accidents are a little more occurring in crowded area especially due to vulnerable motorcyclists and drivers.
3. The result shows that Zone 65 (49-49.5 mile) is the most dangerous place in 2010 and Zone 33 (33.5-34 mile) is the most dangerous place in 2018.
4. It is discovered that seriously injury type accidents are more than minor injury type accident in both years.
5. Night time accidents are more than in daytime in both year. This may be attributed to drink driving, drowsiness and over speeding in night time.

6. Motorcycles and motorcars are the most accident occurring vehicles for both years and so motorcyclists should wear helmet and should be enforced to follow traffic laws and helmet laws for them.
7. Male are more involved than female in road traffic accidents in both years 2010 and 2018.

As future work for this study, after identification the hazardous zones along this route, this locations should be upgraded with efficient and suitable safety geometric design, signs, markings and countermeasures in order to achieve better road safety and better characteristics for this highway. Further, programs such as road safety education and safety campaign for public should be carried out to improve highway safety. Moreover, research related road safety management should also be conducted.

6. ACKNOWLEDGEMENTS

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