

# THE DIFFERENT NATURE OF ACCIDENTS IN THE URBAN, VILLAGE AND RURAL AREAS IN BOTSWANA (1995 – 1998 ACCIDENT STATISTICS)

by

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## **ABSTRACT**

*Botswana has not been an exception when it comes to road traffic accidents. Each year is characterized by an increase in road traffic accidents, which have claimed lives of citizens who constitute the economic manpower of the country.*

*The main objective of the study is to carry out analysis of the traffic accident data for Botswana in order to understand what different natures of accidents occur in the city, village and rural locations. The study will also attempt to identify the major causes of traffic accidents in these locations. The differences in nature of road traffic accident in different locations was revealed through the analysis of road traffic accidents data for the period 1995 to 1998 through the use of a Transport Research Laboratory tool called Microcomputer Accident Analysis Package version five (MAAP5). The study revealed that the three locations indeed do have different natures of road traffic accidents. The rural location has a high severity and the most common accidents are a 'roll-over' type of accidents, while the city location showed a high occurrence of side and pedestrian accidents and the village location showed a high occurrence of 'roll-over' type of accidents and 'nose-to-tail' type of accidents. The results also show a clear indication that road traffic accidents are not influenced much by the geometry and layout of the road, but that road user behaviour plays a major role in accidents causation.*

**Keywords:** Botswana road traffic accident, City location, Village location, rural location, Microcomputer Accident Analysis Package version five.

## **1. INTRODUCTION**

Traffic accidents are among the major causes of death in Botswana, especially among road users in the age group of 0 to 39. Road traffic accidents in Botswana are estimated to be growing at about 10% per annum and have become one of the significant diseases of industrial societies and are an increasing public health and economic issue in developing countries. The fatality rate per 10000 vehicles in Botswana appears to be one of the highest in the world. Traffic Accidents deaths in Botswana exceeded deaths from all infectious diseases in the period 1995 to 1998. About 32% of all deaths in Botswana occur on the road system, and these represent the major cause of death for people aged

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from about 5 to 35 years. Since the age distribution of road accidents victims is tilted towards the young, life expectancy is shortened and hence loss of productivity is substantial, compared with the more frequent causes of death (cancer and heart disease), which are associated with old age excluding the current killer disease AIDS/HIV.

Accident records indicate that in a 4-year period (1995 – 1998), 46135 accidents occurred in the whole country of Botswana. In the same period 23547 casualties were recorded, of which 1612 were fatalities. In 1995, about 9536 accidents occurred, being privately owned fleet. In the same year 5247 casualties, 410 deaths, 1420 serious injuries and 3417 minor injuries respectively were recorded. Fatalities per 10000 vehicles dropped from 34.8 in 1995 to 26.3 in 1996, while fatalities per 100000 population also dropped from 26.5 in 1995 to 21.1 in 1996. Both fatalities per 10000 vehicles and 100000 population started rising over the remaining period to 29.4 and 26.5 respectively in 1998.

However, while the economic and public health issues may be significant, the problem as perceived by the individual traveller seems quite different. The chances of death on any given journey, no matter how hazardous, are extremely small. Ogden (1996) for example has estimated that the probability of being killed in a road accident is about 1 in one thousand per year, or 1 in one million per trip or 1 in one hundred per lifetime. This contrast between the societal problem and the personal problem is at the crux of road safety policy. The personal problem may be measured in terms of the death rate per vehicle or per vehicle kilometre. By comparison, the number of deaths per head of population best measures the societal problem.

This study revealed, through traffic accident analysis by a Transport Research Laboratory Microcomputer Accident Analysis Package tool, that different locations have different natures of accidents as influenced by the difference in the road network layout, speed limits, pavement surface etc. in each location. Accidents that occur in the village and rural locations have a high severity index than those in the urban location of all these accidents the human element was found to be the major contributing factor to the occurrence of accidents, which therefore mean that emphasis needs to be placed on changing the driver behaviour and attitude in the road system and put in place legislation that would help deter the 'would-be' culprits. Studies such as this one help to focus attention on issues that need to be addressed to arrest the situation. What must now be considered the most important angle of approach is that of bringing influence in human behaviour and attitude, which is the main cause behind at least 90% of serious road accidents. Many accidents can certainly be attributed to a concurrence of circumstances or coincidence of events, but in many of these cases an accident would not have occurred if the driver had acted in a more responsible way.

### **1.1 Objectives**

Accident investigation and analysis of data on road accidents help determine the factors involved in accidents, so that appropriate road or traffic engineering, educational and enforcement remedial or preventative measures may be applied. The main objective of the study is to carry out an analysis of traffic accident data from Botswana in order to understand the different natures of accidents in city, village and rural areas in Botswana

and identify the major causes of traffic accidents in the three locations. The findings can be used to plan publicity campaigns in a more effective manner by targeting “at-risk” groups identified from the data e.g. drivers, young pedestrians, passengers of pick-up vehicles on rural highways.

## **1.2 Data**

The main source of data used in this report is drawn from Department of Transport and Safety and the Police in Botswana. The production of these accident statistics is very much a joint effort by the Botswana Police and the Department of National Transport and Communications – Road Safety Division. Most road accidents, especially those involving injury, are attended by a police officer. Details of the accident are recorded on site and are later entered onto an accident report form by the investigation officer. The accident data used is for the period 1995 to 1998 covering the whole country of Botswana. The forms from all over the country, are sent to the Police Traffic Branch in Gaborone where the data are checked and entered into the microcomputer system of both the Departments of Police and Transport. Both departments use a Microcomputer Accident Analysis Package version *five* (MAAP5), developed by the Transport Research Laboratory (TRL) in the United Kingdom.

As with any computer data, the quality of the data coming out can only be as good as the quality of the data going in, and this means that people should be aware of certain limitations in the collection of the data and interpret the results accordingly. Data are significantly affected by the relative influence of the various parties, which are potential users of the system. There are many potential users, and their needs are not identical, and in many cases may even be in conflict.

## **1.3 Methodology**

The method adopted to investigate the different natures of traffic accidents by location type, involved accident data analysis through the use of a program developed by TRL called MAAP5 (Microcomputer Accident Analysis Package version Five). MAAP has a wide range of uses, from generating national annual cross-tabulations to the in-depth diagnosis of road accident data at the ‘local Authority’ level. Its features include:

- Cross-tabulations giving a general overview of the accident problem in the region, in particular identifying within the population those groups most at risk; or at a local level, giving detailed analysis for accidents at a site.
- Plotting accidents on scanned or vector maps, enabling those locations in the region with high accident rates to be easily identified.
- Stick diagram analysis which assists the investigator in uncovering common factors in groups of accidents.

The accident data can be analysed in three stages, as accident only data, casualty only data and vehicle only data. In this study all the three categories were used for the analysis of accident data. Cross-tabulations were selected based on a framework that would help reveal the nature and type of accidents that occur in the three types of location. The approach was to run cross-tabulations per each location type. Each category of location type was then further divided into junction and non-junction accidents. For the junction

accidents a further division of signalised and non-signalised junction was done. Comparisons of different attributes that contribute to accidents that have influence in the elements of the nature of accidents in a given location were analysed. The analysis includes an overall scrutiny of the three locations and then a comparative analysis of all accidents, all casualties, vehicle only and pedestrian accidents. In all of the above mentioned categories the separation of causal elements was carried out, i.e. Road environment, driver and the vehicle elements which contributed to the accident. An aggregation of accident data was done for analysing the overall accident data by location type. Aggregation by location type is necessary to identify clustering of accidents in order to identify and prioritise sites per treatment called the area action application.

## 2. ANALYSIS OF RESULTS

The following notes are intended to assist in the interpretation of the tables and diagrams in analysing the results in the context of this study.

### 2.1 Accident Severity

Accident Severity is determined by or classified according to the most severe casualty sustained by any person involved in the accident. Severity is also used to rank accidents. For instance, if an accident results in one fatal casualty, two hospitalised casualties and two non-hospitalised casualties, the accident is referred to as a ‘fatal accident’.

***A Fatal accident*** – is defined as one in which death occurs on the scene of the accident or/and within a given period of time as a result of injuries sustained in the accident. In Botswana the period is 30 days.

***Serious accident*** - is defined as an accident in which a person is detained in the hospital as an “in-patient” or any of the following injuries whether or not one is detained in the hospital: fractures, concussion, internal injuries, crashing, severe cuts and lacerations.

***Minor accident*** - is one in which a person is treated for minor injuries and released to go home thereafter.

Damage only accident is one where no persons are injured at all.

### 2.2 Location Type

- City- covers roads within cities and towns only with speed limits of 60 and 80 km/h.
- Village- this refers to the environment within the village and settlement boundaries, which includes a few kilometres of the village part which is undeveloped and has speed limits range of 60 km/h within the village to 120 km/h in the out skirts of the village. The portions of the village roads that have high speeds are part of the nation highways.
- Rural- this refers to the national highways that link the towns, cities, villages and settlements together. These roads run through virgin land and have the highest speeds limits of 120 km/h.

All of the above mentioned location types have both tarred and gravel roads.

A note of warning must be issued in relation to the interpretation of the Tables. Absolute numbers in the Tables must not be taken at face value without considering the context in

which those numbers appear. For example, in locations where there are concentrated numbers of vehicles and pedestrians i.e. urban areas, the likelihood of accidents due to the sheer number of vehicle miles travelled and the number of pedestrian movements i.e. exposure, is greater than in areas where there are few vehicles and pedestrians. It may be noticed that there is a difference between some 'TOTAL' figures at the bottom right corner of Tables where it might be expected to be the same. The reason for this is that the coding of accident report forms allows the officer completing the form to enter a question mark (?) for items of information that are not known. If a Table includes an item for which a particular record form shows a '?', then that record (or casualty/vehicle/driver) will not appear in the table. The total will therefore vary slightly from table to table, depending on which particular items are being illustrated by that table.

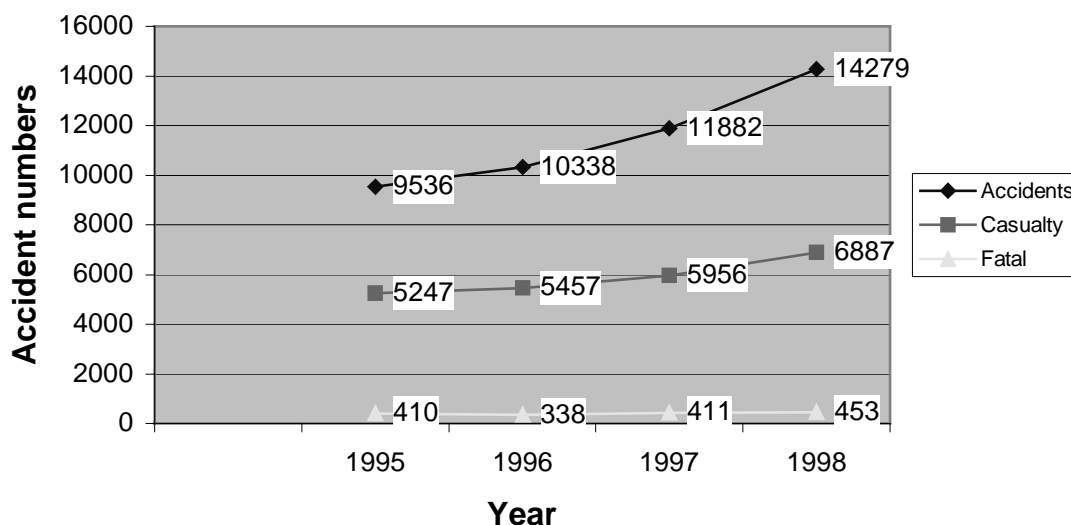
### **3. ALL ACCIDENT ANALYSIS**

#### **3.1 1Annual Trends 1995 - 1998**

Table 1 shows a significant increase in total numbers of accidents from 1995 to 1998. A corresponding increase is also shown in total numbers of casualties for the same period. However there was a fall in fatal accidents from 1995 to 1996, then a steady rise since then and in 1998 the figure has reached 453 i.e. 43 more fatal accidents than the 1995 figure. There was no new law enacted that can be attributed to the drop in fatalities in 1996. However there was a steady increase in law enforcement as the police recruit more officers annually and the National Road Safety committee has also developed a more focused education strategy for all road users. It is these two areas that could have brought about the drop in fatalities.

Fig 1 below shows graphically all the trends for the total accidents, casualties and fatal accidents. The table also shows that road accident fatalities per 10000 registered vehicles dropped from 1995 to 1996 and rose again in 1997 and remained steady in 1998. The figure for 1998 of 29.4 is still lower than the 1995 figure by 5.4. For road accident fatalities per 100 000 population dropped from 1995 to 1996 and experienced a steady rise to 1998 to the same figure of 26.5 as for the year 1995.

**Fig 1: Accident trends**



**Table 1: Annual Accident trends (1995 – 1998)**

Accident variables					
Year	Accidents	Casualty	Fatal	Fatal/ 10000 veh	Fatal/ 100000 pop
1995	9536	5247	410	34.8	26.5
1996	10338	5457	338	26.3	21.1
1997	11882	5956	411	29.4	24.8
1998	14279	6887	453	29.4	26.5

The table above shows that the total number of accidents reached 14279 in 1998, this represent on average an annual increase of 12% on accidents over a four year period. Similarly the casualties have also been rising at an average rate of 8% annually over the same period. The fatal accidents for this period were 453 which is about 3% of all accidents that occurred in the same year. The fatalities have been rising at an average rate of 3% per annum over the four-year period.

**Fig 2: Road accident fatalities**

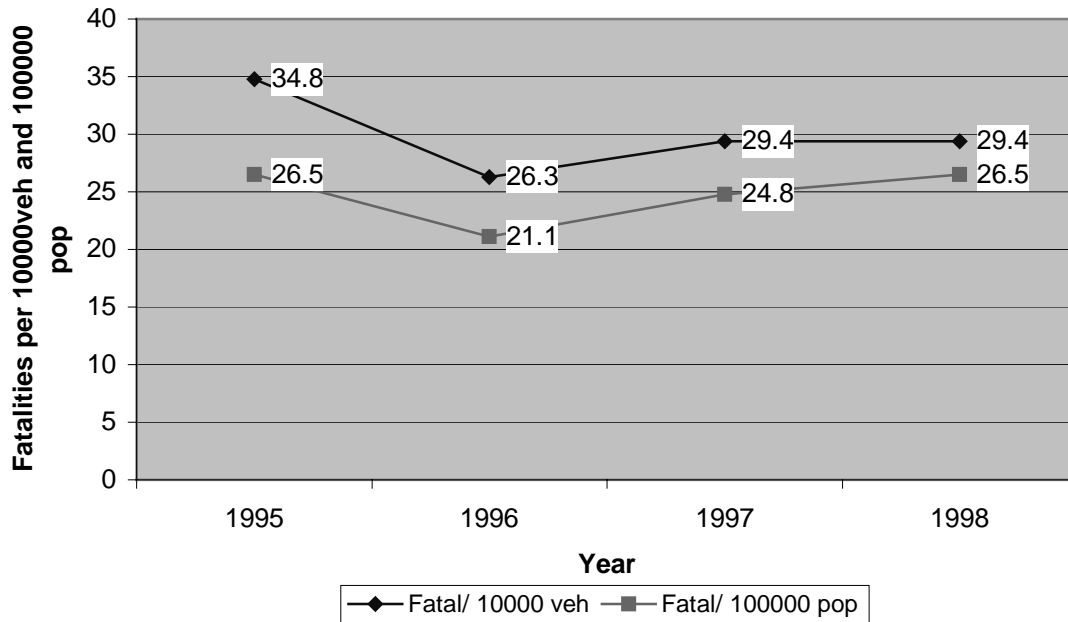


Fig 2 shows that there has been an improvement, though not so great an improvement, in both fatalities per 10000 vehicles and per 100000 population. This improvement is evident by comparing the 1995 values with the 1998 values. However after the drop in 1996 the personal problem measured in fatalities per 10000 vehicles rose and remained the same for two years which is an improvement since both the accidents and casualties increased in those years. Similarly the societal problem measured in fatalities per 100000 population kept rising steadily since 1996 and reached the same value for 1995 in 1998. Table 1 also shows that accidents are more in numbers than casualties. Casualties are approximately half of the accidents in number. This is so because the majority of accidents or a higher proportion of accidents are damage only accidents. This means that there are accidents which happen but do not yield any casualties or there are no persons injured during the accident. However, there are circumstances where the number of casualties can exceed accidents in instances where a single accidents results with more casualties e.g. a bus accident. However, this scenario applies only to analysis of single accidents. The analysis of aggregated accidents gives the reverse of the above statement as evidenced in table 1 above.

### 3.2 Accident Analysis by Location Type

The analysis of accidents by location of accidents help to relate accidents to different locations and study the pattern of accidents in the different location and determine the effects of locations on accidents. Accidents were grouped into three major locations types viz; Location type 1 which is the city/urban centers, Location type 2 which is the village setting and Location type 3 which is the rural setting. Comprehensive definition of these locations has been given previously. Location type 1 constitutes about 14% of the country's total road network, Location type 2 constitutes about 25% of the country's total road network and the largest proportion of about 62% of the country's total road network

is found in Location type 3. Location type 1 carries an Average Daily Traffic of about 1788 vehicles. Location type 2 carries an average daily traffic of about 986 vehicles while location type 3 carries an average daily traffic of about 872 vehicles. This shows that about half of the country's vehicle fleet is found in location 1 which also has the smallest road network compared to the other two locations. The analysis of all accidents reveals that location type 1 (total accidents of 18741) has a higher number of accidents compared to location 2 and location 3, which have total accidents of 16915 and 8410 respectively. As mentioned before this is due to a high concentration of vehicle in location 1 with a small road network.

**Table 2: Location type by collision type for all accidents**

Collision Type	Location Type			Total
	City	Village	Rural	
NoseT	5251	2122	523	7896
Side	6740	3089	711	10540
HeadO	622	664	439	1725
Ped'n	1995	1461	146	3602
WildA	219	399	491	1109
DomAn	714	3584	2797	7095
Obstl	1631	1381	479	3491
Rollr	568	1755	1591	3914
Other	2747	2639	1308	6694
<b>Total</b>	<b>20487</b>	<b>17094</b>	<b>8485</b>	<b>46066</b>

Table 2 above shows that for all accidents that occurred between 1995 and 1998 about 44 % happened in the city location, 37 % in the village location and about 18 % in the rural location. The city location experiences side collision as the predominant type of collision followed by the nose-to-tail type of collision. The predominant collision type for location types village and rural is the one which involves wild-animals with the village location showing the highest numbers of accidents. This high number can be attributed to the large number of vehicles and domestic animals found in this location type. The second dominant collision type in the village location type is the side collision which too can be attributed to the high numbers of vehicles than in rural location, while it is lower than the accidents in the city location. The second predominant collision type in rural location type is the roll-over, which is so because the vehicle speeds on these roads are high which normally result in roll-overs in case of loss of vehicle control.



**Table 3: Junction type by collision type (all casualties)**

Collision type	Junction type							Total
	Not-J	Cross	T/Junc	Y/Junc	Round	Rail	X	
NoseT	1622	100	304	23	11	15	76	2151
Side	2107	463	802	27	18	64	198	3679
HeadO	1433	55	191	7	6	3	96	1791
Ped'n	3373	92	281	18	9	4	105	3882
WildAn	209	0	10	0	0	1	15	235
DomAn	1363	14	24	1	0	1	21	1424
Obstl	536	4	48	1	12	6	18	625
Rollr	6824	18	233	18	15	4	117	7229
Other	2121	68	247	17	26	18	107	2604
<b>Total</b>	<b>19588</b>	<b>814</b>	<b>2140</b>	<b>112</b>	<b>97</b>	<b>116</b>	<b>753</b>	<b>23620</b>

Table 3 above shows that 83% of all casualties are for accidents that occurred on a straight road, with the T-junction and cross roads contributing about 9% and 3% respectively to all casualties for the period between 1995 to 1998 for the three locations. The most dominant type of collision was the rollover at 31% followed by side and pedestrian accidents at 16% each for the three locations. The 'nose-to-tail' and 'head-on' collision types account for 9% and 8% respectively.

The study reveals that the dominant collision type in location 3 is the 'roll-over' accounting for 49% of all casualties and Domestic animals collision type accounting for 10% of all casualties in this location. The reason for the rollover being the dominant collision type is the fact that this location has roads that have high speeds limit, i.e. 120 km/h. Therefore because of high speeds any mistake on the road may result in a rollover. In this location domestic animals are many because the roads traverse through cattle post and farms where cattle and similar domestic animals are reared. It also revealed that just like location 3, location 2's dominant collision type is the rollover at 33%. Comparatively rollover casualties are more in location 2 than in location 3. The reason for this has not been unveiled, however, location 2 has high speed limit on its periphery which normally result in rollover collision types as speed limits are similar to location 3 but they drop down to 60 km/h in the middle of the location. The second dominant collision type in location 2 is the pedestrians, which account for 16% of all casualties in this location. The reason being that there are more pedestrians with less provision of pedestrian facilities. It also revealed that in location 1 pedestrian collision type is the highest at 30% of all casualties in the location followed by side collisions which account for 24% of all casualties in this location. The reason for a higher pedestrian involvement in this location and even against the other two locations is that there are more pedestrians and more vehicles all competing for the same road space, which results in more accidents. The totals for each location show that there are more casualties in location 2 than in location 1 and 3. This is so because location 2 has a higher population on aggregate compared to

location 1 and 3. A cross tabulation of collision type by the cause of the accident showed the major collision type as side and nose-to-tail which accounts for 29% of all casualties in accidents in the three locations for the 1995 to 1998 period caused by 'any other negligence'. The number one collision type is the 'side' collision accounting for 36% of accidents caused by 'any other negligence' followed by the 'nose-to-tail' collision type. These, as seen previously, are prevalent in location 1 and 2 respectively. The second cause of accidents accounting for 18% of all casualties accidents are accident caused by 'other animals in the road', with the highest collision types being domestic and wild animals each accounting for 11% and 77% of all casualties by this cause of accident respectively.

The study revealed a common peak in accidents for all locations at a time period of 18.00 to 20.00 p.m. There is a rise in accidents from a time period of 04.00-06.00 to 06.00-08.00, and between time period of 16.00 to 18.00. These are the time periods when the roads are busy as people travel to their work places and make trips back to their homes from work. For locations 1 and 2 most of the accidents occur over the weekend, Saturday being the day with the highest number of accidents followed by Friday. Similarly for location 1 the accidents occur over the weekend but the day with the highest number is Friday.

#### **4. ENVIRONMENTAL FACTORS**

##### **4.1 Weather influence**

Information from the meteorological department show that over the period between 1995 and 1998 there were on average 36 days in a year that were rainy with greater than 1mm of rain fall. Therefore the fine days were 329 days. This information means that for all the three locations there were 127 accidents per a fine day occurring, and 56 accidents per a rainy day. About 91% of all accidents occur during dry surface conditions with about 6% occurring during wet surface conditions. Of the accidents that occurred on a dry surface 99 % were on a non-slippery surface. The wet surface is not a major contributing factor to accident causes because the rate of accidents per a wet day is less than the rate at which accidents happen on dry days. This is another information that shows that the environment contribute less to accidents occurrence. This clearly shows that rain does not significantly influence accidents. The study revealed that on average about 65% of all accidents happened during daytime, this could be due to the fact that it is the part of the day when travel is at its peak, i.e. people travel more during daytime than after sunset. However further investigation is required to establish the relative proportions of daylight and night-time traffic mileage driven.

#### **5. ROAD CONDITION AND GEOMETRIC LAYOUT INFLUENCE**

Most of the accidents were found to have occurred on flat road slopes with a few occurring at inclined, crest and dip road slopes. About 88% of all accidents occurred on a straight road and 80 % of all accidents were on tarred roads with only 13 % on gravel roads. In all the three locations accidents occurring on a straight outnumber those which

occur on the open and blind road curvature. 98% of all accidents occurring on the straight are on a flat road slope, leaving only 2% of the straight accidents occurring on the inclined, crest and dip road slope. Of all the accidents that occurred on tarred roads 98% occur on a smooth surface quality, which means only about 2% occur on corrugated and potholed surface quality. For all the different road surface types 85% of the accidents occurred on the smooth surface quality. Location 1 has higher rates of accidents occurring on tarred smooth roads, with tarred road accidents accounting for 92% and tarred smooth road accidents account for 95%. This Location has higher occurrences on tarred roads because about 78% of the roads are tarred.

These results show that road surface type and surface quality do not contribute significantly to accident causation. This reinforces the observations reached that the environment seems to be contributing less to accidents.

## **6. HUMAN FACTORS**

### **6.1 All Casualties**

The study reveals that there are more casualties in location 2 (Village) than in location 1 and 3. This is likely due to the population distribution in Botswana, since there are more villages and settlements than urban area. Hence more people in location 2 than in locations 1 and 3. However there are fewer vehicles in location 2 than in location 1 and the number of all accidents in location 2 are smaller than in location 1. What probably makes the casualty number higher in location 2 than in location 1 is the spirit of vehicle sharing, which is more prevalent in this location? This therefore means in case of an accident the casualties will be more.

The analysis of the data show that on average about 66% of all casualties result from daytime accidents dominated by a fine weather. Accidents in the dark account for about 26% of all casualties in locations 2 and 3, while in location 1 they account for only 11% of all casualties. The lower percentage in location 1 is due to the fact that there are more lit streets in location 1 than the other two locations.

In all of the three locations the '*stop junction control*' has more accidents followed by the uncontrolled junctions in locations 2 and 3. Location 1's second '*junction control*' with high casualties is the signalised junctions with the uncontrolled being the third. This trend is similar to all accidents pattern of junction accidents. Apart from the apparent difference in numerical numbers between casualties and accidents the pattern is basically the same.

### **6.2 Pedestrian accidents**

Pedestrian accidents show the same pattern as for all accidents. This is so because the busy time periods are the same for all accidents and pedestrians. This therefore enhances the conflict that exist between vehicular traffic and pedestrians as these road users compete for the space available, especially that pedestrian facilities are inadequate in Botswana. On average about 66% of pedestrian accidents occur when pedestrians are crossing the road, 19% occur due to other pedestrian manoeuvre other than those

mentioned on the traffic form while 9% occur when the pedestrian was walking in the road. Where there are footpaths only 4% of the pedestrian accidents contribute to all pedestrian accidents. This information clearly shows that there is a problem in the way pedestrians cross the road or the driver's attitude toward pedestrian even traffic rules and signs.

The worst location is location 1 with 71 % of all pedestrian accidents in this location occur during crossing. Location 2 being the second with 61% while location 3 has 45% of its pedestrian accidents occurring from crossing the road. It is true the location one has more traffic with less road network and pedestrian facilities which exacerbate the problem. Conversely Location 3 has fewer pedestrians due to its location and characteristics, since it is mostly primary roads linking together places. However, location 3 shows a high fatality rate than the other two locations. This location has 30% of all pedestrian accidents as fatal, 36% serious and 35% minor. The reason for the high fatality rate is due to the fact that this location has high speed limit roads, where when an accident occurs involving a pedestrian the chances of survival are less. Location 2 has a fatality rate of 17% and location 1 has a fatality rate of 7%. The lower rate of fatality in location 1 is due to slower speeds, which increases the chances of survival where pedestrians are involved. The overall fatality rate for the three locations is 23% with serious pedestrian accidents accounting for 58%.

The population census revealed that the majority of the people are below the age of 30. Education Statistics (1997) shows that there were a total of 457441 students that enrolled at all levels of education. Therefore there are 1038552 people who are not attending any form of education. The ratio of students to non-students is 1:2.27. This ratio ties well with the accident involvement of students or pupils showing no over involvement.

## **7. VEHICLE FACTORS**

A total of 62893 vehicles were involved in reported accidents from 1995 to 1998. With a total vehicle population of 154000, this means that 41% of all vehicles on the road were involved in a reported accident. Data analysis revealed that more pick-ups were involved in accidents than any other class of vehicle; 42% on average of all vehicles involved were pick-ups. Location 3 has a higher proportion of pick-ups involved than locations 1 and 2. The reason for this is that most of the roads in location 3 are accessible by pick-ups than cars. This does not necessarily mean that pick-ups are more dangerous than other vehicles. It largely reflects the fact that pick-ups form the largest class of vehicles of the total vehicle fleet. Further analysis shows again that the next most involved vehicle type is the car with a percentage of about 27%, for this vehicle type the car involvement is more in location 1 than in locations 2 and 3. The reason for more car involvement in location 1 is because most of the roads are paved in location 1 and cars are cheaper to run.

Pick-ups have been found to have a vehicle kilometre per class of 413930023 while cars are the next with 200980695. The vehicle kilometre per vehicle per year of pick-ups is

12103 while cars have 5031. The more the vehicle kilometres done the more the exposure, which is one of the reasons why pick-ups are more involved in accidents.

Of all the vehicles involved in accident in 1995 to 1998 over 99% had their lights working well, while only less than 1% had faulty lights. For the vehicles, which had good lighting system, 94% were loaded legally or in acceptable way of loading and only 6% were loaded illegally. This is evidence that proves that the loading and lighting system of the vehicles and the road worthiness of vehicles are fine and contribute insignificantly to accidents occurrence.

## **8. DISCUSSION**

### **8.1 Methodological Issues**

There are several factors that might in principle limit the generalisability of the results. The available data was over a period of 4 years, i.e. 1995 to 1998. This data was analysed using MAAP-five which provides a wide variety of cross-tabulations to chose from. This makes it possible for even important cross-tabulations to be left out since the database is so large.

The cross tabulation that involves the causes of accidents are subjective to what the drivers, witnesses and other parties involved in an accident would tell the officer investigating the cause of the accident. Where an accident does not have many who observed or witnessed it then the driver is likely to give other false reasons as the cause of the accident to cover himself so as to avoid charges. The Police accident report form does not have any attributes that say much about the road worthiness of the vehicles, therefore it can not be obtained from MAAP5. Hence accident causes which were a result of a defect or mechanical failure of the vehicle will not be recorded.

### **8.2 Interpretation of findings**

In the following notes interpretations are made of the data contained in each table and attention is drawn to particular points of interest as far as the effects of location types on the nature of accidents is concerned. It should also be noted that the interpretation of the tables is inferred where no conclusive information is available rather than being obvious and is not intended to be exhaustive. Accidents often happen because there were combinations of factors that lead to its occurrence. The issue that is still unresolved is whether one should use the casualties or accident numbers in accident studies. The casualties have been found to magnify the problem since a single vehicle in a single accident can have a large number of casualties, while an accident can under estimate the magnitude of the problem by disregarding the casualties. This study will only use the accident numbers for analysis.

The statistics and analysis shows that most, if not all of these accidents, are a result of the human element agreeing with what has been established by Shinar (1978). It is true that a human being is born with error hence some of the accidents are a result of errors that people make.

## **8.2 Implications**

One implication of the findings is that basic training is not providing drivers with adequate skills, knowledge or attitudes to prevent a relatively high risk of accident of particular type such as hitting other vehicles from behind and losing control of the vehicle. Experience in the first year or two of driving goes some way to reducing this risk. This raises the question of whether it might be possible to change the way that driver training is implemented to accelerate the process of gaining experience Wyss (1976). The experience of dozing at the wheel has been shared by all too many drivers. Why do we experience fatigue while driving “effortlessly” in modern cars? The answer appears to be that driving, while it may not require excessive muscular work, does require mental work.

Driver training through set training standards is an essential element in enhancing traffic safety, this element still lacks in Botswana. The interaction between motivated bad driving and inexperience in increasing accident risk supports the view that many accidents arise from willingness to violate rules placing drivers in a position in which errors arising from inexperience are punished by a collision. Experienced drivers do suffer the problem of wilful violation of rules as well, because of being impatient with other drivers (especially novice drivers as revealed by West (1998)). Parry (1968) concluded that there are a whole lot of different reasons and/or causes of accidents on the road.

## **8.4 Safety Legislation**

Department of the Environment (1976) concluded that a necessary consequence of the motorization of a country is the introduction of a detailed legal structure of laws relating to traffic. Traffic laws aim to control behaviour and punish activities which are perceived as either antisocial or likely to lead to collision. The use of law, however, as a positive mechanism for generating behaviour change in the context of traffic to reduce the incidence of collisions, is a controversial strategy and has generally been applied ineffectively, with some notable exceptions.

In general terms, the law is only a reflection of a community’s values and the application of legal sanctions can work only if there is a tacit acceptance of the law by the majority of people, and an infrastructure available which will allow enforcement of such laws on the minority who do not conform. Hence traffic law, as a mechanism for behavioural modification, is not the only panacea in developing countries.

## **8.5 Drivers**

The Traffic Act stipulates punitive measures taken against reckless, inconsiderate, over speeding and drink and drive drivers. In Botswana there is currently no legislation regulating driving schools. The existing driver training facilities are far from the required standard. As a result there is an ongoing review of the Road Traffic Act to set standards and criteria for driver competency evaluation. The current situation where under trained instructors do training under the trees sacrifices standards since the teaching-learning environment is not at all conducive. The absence of a prescribed driver training Curriculum compounds this unfortunate situation.

The upsurge of road traffic accidents each year in Botswana defies all interventions and efforts aimed at promoting orderly road traffic on the national road network. Even after enacting laws that carry heavy penalties for offenders, road traffic accidents are still happening at an almost constant rate. Enforcement and education need to be reinforced.

### **8.6 Pedestrians**

Provision in legislation should be made to deter pedestrians from acting irresponsibly on the road. Currently, no charges are ever preferred against pedestrians even where it was proved that they contributed to the cause of an accident in Botswana. It is equally important to note the fact that many roads in the country do not have areas designated for pedestrians to cross. In some areas where these facilities are in place, they are rarely used unless when Traffic Police are there. Sometimes these facilities are wrongly used. It has been observed at most Zebra crossings; pedestrians plunge in the road without taking necessary precautions and exercising vigilance. The behaviour of pedestrians seems to signal an “*its your business to save our lives*” attitude to the motorists. It is unfortunate that the most vulnerable road user is the pedestrian, yet they are willing to risk their lives at all costs to reach their destinations.

## **9. CONCLUSION**

This study has demonstrated that different location types have different natures of accidents. The locations have different severities with the rural area or location type 3 showing accidents with high severity index because the speed is high on rural area location type. The more dominant collision type in this location is the rollover collision type, which is mostly influenced by high speed. Location type 1 which is urban areas experiences side collisions and pedestrian accident because of the high numbers of cars, which compete with pedestrians for the same road space because there are inadequate pedestrian facilities. The higher number of junctions increases the conflicts between different vehicle movements, which results in more side collisions. Location 2 was found to have more rollover and nose-to-tail collision types which are influenced by high speeds and following too close behind the vehicle in front.

The study has also revealed that about 83% of all accidents occur on areas not associated with junction while junction accidents account for only 14 % of all accidents and 3% are accidents that occur at places with the form of geometry different from the ones stated in the police report form. The road curvature, slope, slipperiness, weather conditions, surface quality, type of road surface and road markings were found to be contributing quite insignificantly to accident occurrence.

The vehicle conditions were found to be contributing less to accident occurrence in that a higher percentage was found to be in a good roadworthiness conditions. Alcohol was revealed to be less involved in contributing to road accidents. The major cause was found to be negligence, animals on the road, crossing without looking and failing to comply with traffic signs and/or signals. This confirms the premise held by Naatanen and

Summala (1976) that the human factor is indeed a major cause for most of the accidents that occur on the roads in Botswana.

The Road Traffic Act has not been effective because of the drivers' growing appreciation that the real risk of being detected and convicted, though higher than before, remain low for most if not all of the offences. A growing indication to take a chance has been reinforced by well-known technical defects in the Act, which suggest that even a positive test, for drunken drivers, need not cost a driver his licence. It is evident that there need for legislature review and reinforced enforcement of the traffic rules. Training and educating the public at large, especially drivers and the youth school going age in a bid to mould their attitudes towards road safety.

## **10. RECOMMENDATIONS**

The recommendations made based on the findings of this report are:

- Setting up all over the country of official centres for motoring instruction, staffed by instructors who have themselves passed a specified high-level course of instruction.
- There is also a need for all private schools not only to be registered but also to have only instructors who had passed these "official" instructors' course.
- Endeavours should be made to change driver behaviour towards safer ways of using roads and tolerance towards other road users, especially were there are inadequate pedestrian facilities and above all change of attitudes by;
  1. Better selection of the road users through licensing. People should go through physiological, psychological and performance tests.
  2. Improvement of the performance of the road users through enforcement, education, information, training, campaigns etc.
  3. Adjusting the design of roads, signals, vehicle regulations etc to the characteristics of man.
- The other major element in creating respect for the law and in deterring potential offenders is to have stern sentences. There should be a mandatory minimum period of disqualification as an effective deterrent.
- More effective enforcement alone is not enough. It is essential that the police should have the full support of public opinion for their work to be practical and effective.
- There should be a continuing programme of publicity, having particular regard to the education of young drivers and pedestrians, to develop informed and responsible attitudes to bad driver behaviour and enlist public support for the law. Social and road safety education should prepare pupils for what has become a major hazard of young adult life.



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