

A Statistical Analysis of Vehicle Accident Cases in the Western Region, Ghana

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Abstract

Motor-vehicle accident is an unexpected event which produces unintended injury, death or property damage involving one or more vehicles on the road. The focus of this study was to examine the rate of reported Motor-Vehicle accidents in the Western Region of Ghana and also to determine the type of vehicles that are involved in such accidents as well as the periods in which these accidents occur. The analysis of data was carried out by the use of percentages, chi-square and analysis of variance. The data is a monthly returns submitted by the Western Region Branch of Driver and Vehicle Licensing Department (DVLA) in collaboration with National Road Safety Commission (NRSC) and the Motor Traffic and Transport Unit (MTTU). On the question of serious and fatal accidents, fatal accidents increased over the period of study while that of serious accidents decreased. It was also observed that private vehicles contributed to most of the accidents followed by commercial vehicles while tractor and earth moving machines, bicycles and carts contributed less to the number of recorded accidents. However the period of occurrence of accidents over the years was mostly recorded in the first and fourth quarters, which falls within the festive seasons in Ghana i.e. Easter and Christmas seasons. Further analysis also revealed that the type of vehicles involved in accidents and the year of occurrences are not dependent. Finally though the accident rate was decreasing over the period of study the mean accident rate over the years under study are not different.

Key words: Motor Traffic and Transport Unit, National Road Safety Commission, Vehicle Licensing Department

1. Background

Accident is an unintended and unforeseen event usually resulting in injury or property damage. (Encarta, 2002). Accident may be due to carelessness or misconduct of an individual or group of individuals, or a loss caused by lightning, floods, or other natural events. The basic causes of accidents are, in general, unsafe conditions of machinery, equipment, or surroundings, and the unsafe actions of persons, caused by ignorance or neglect of safety principles.

Motor-vehicle accident is an unexpected event which produces unintended injury, death or property damage involving one or more vehicles on the road. There are three types of accidents: "fatal" where death occurs, "serious" where persons sustain injuries and may be maimed/deformed, or damage to properties at times beyond economic repairs and "minor", where person(s) sustains minor injuries normally treated and discharged with slight damage to properties.

The first components of accidents are most importantly human which consist of driver, passenger and pedestrian. The second are good (tarred/asphalt) roads and bad (rough) roads. The third is the roadworthiness of vehicles (i.e. all necessary accessories on it, e.g. brake lights, traffic indicators, good tyres, headlights etc.) and lastly the environment and weather, that is rainy or sunny (Road Safety Dialogue, 2005).

Motor-vehicle is a single greatest cause of accidents in the developed world. The huge rise in the number of motor cars in the 20th century has resulted in approximately 5,000 deaths a year from vehicle accidents in the United Kingdom alone. In almost all countries in Africa, Asia and Latin America road accidents have become one of the leading causes of death. Despite this serious problem, little attention has been paid to road accident prevention in most developing countries.

(reference please)

Road accidents are increasing in Ghana and in recent times claiming so many lives. According to the 1994-1998 police data, road accident is one of the leading causes of death and injuries in Ghana. In 2001, the Ministry of Roads and Transport (MRT) and the National Road Safety Commission (NRSC) launched a first 5-year medium term National Road Safety Strategy 2001-2005 (NRSS 1). The strategy was intended to create a framework for coordinated interventions in road safety with the view to reverse the upward trend in road traffic fatalities by the end of 2005. Also, the strategy was meant to provide the basis for enhancing the safe use of roads in the country.

The situation is not different in the Western Region of Ghana. In 2003 for instance, about 4% of the total accident in the country occurred in the Western Region. The general view of the commercial drivers is that,

private vehicle drivers are the most people who are involved in accidents while the private drivers say otherwise. National system of collection of information on road accidents involving human injury will give considerable information about the circumstances of the accident including who the victims are and what type of vehicles are involved and what they were doing at the time of the accidents and the general condition at the time.

1.1 Objectives

It is hoped that this study will provide appropriate information for the Motor Traffic and Transport Unit of the Police Service, the National Road Safety Commission and the Driver Vehicle and Licensing Authority as well as the general public on the state of accidents in the Western Region. This research is therefore aimed at finding out:

1. which group of vehicles, whether private or commercial vehicles, that are mostly involved in road accidents;
2. which quarter of the year accidents occur most; and whether the rate of motor accidents in the Western Region of Ghana is decreasing or increasing over the years.
- 3.

1.2 Research Questions

To enable us meet the objectives of the study the following research questions have been formulated.

1. Do private vehicles get involved in accidents more than commercial vehicles?
2. Does the rate of accident increase or decrease over the years?
3. Does the accident rate increase during the festive seasons?
4. Are the roads in the Western Region of Ghana safe to drive on?

2. Literature Review

Many authors (Mosdale, et al, 2003), (Afukar, et al, 2003) and Rockson A. (2005) have painstakingly delvered with analysis on accidents in various forms. In this section literature works of some authors in respect to motor-vehicle accidents are reviewed. (Mosdale, et al, 2003) There are fifteen precipitating factors out of which five collectively account for 80 percent of accidents. The most frequently recorded factors are *failure to avoid vehicle or object in carriageway* (28% of all accidents). This is followed by *loss of control of vehicle* (19%), *failure to give way* (15%), *pedestrian entering carriageway without due care* (11%), and *poor turn/manoeuvre* (8%). The main precipitating factor in road accidents is *loss of control of vehicle* (43% of fatal and 29% of serious accidents). Only 4% of the accidents are given a precipitating factor which is different from those listed above. There are about fifty-four contributing factors out of which fifteen contribute over 80% to accidents. Twenty-five percent is due to *inattention* followed by *failure to judge other persons path or speed* (23%), *look but did not see* (19%), *behaviour including carelessness or thoughtfulness or /recklessness* (18%) and *failure to look* (16%). In fatal accidents, the most frequently recorded factor is *excessive speed* (28%), followed by *carelessness or thoughtfulness or recklessness* (21%), *inattention* (18%), *lack of judgement of own path* (17%) and *failed to judge other persons path or speed* (16%).

Between 1994 and 1998, a total of 434,012 road traffic accidents were recorded; 9.6% were fatal, 21.8% caused serious injuries, 27.1% caused slight injuries and 41.5% were associated with property damage only. Altogether, there were 53,783 road traffic casualties from 1994 to 1998, injury to fatality ratio is about 9 to 1, implying that for every person killed in road traffic accident, nine other people got seriously or slightly injured.

Road traffic injuries and fatalities are increasing in Ghana (Afukar, et al, 2003). Police collected crash and injury data for the period 1991-1998 were aggregated and analyzed using the MAAPS accident analysis package developed by the Transport Research Laboratory, U.K. Published results of recent transport-related epidemiological and other surveys provided an additional data source. According to the 1994-1998 police data, road traffic crashes were a leading cause of death and injuries in Ghana.

The other leading causes of death and injuries are occupational injuries which involve non mechanized and tribal conflicts. The majority of road traffic fatalities (61.2%) and injuries (52.3%) occurred on road in rural areas than in urban areas and generally more severe crashes occurred on rural roads compared with urban areas. Pedestrians accounted for 46.2% of all road traffic fatalities. The majority of these (66.8%) occurred in urban areas. The second leading population of road users affected was riders in passenger-ferrying buses, minibuses and trucks. The majority of these (42.8%) were killed on roads that pass through rural areas. Pedestrian casualties were overrepresented (nearly 90%) in five regions located in the southern half of the country.

According to Afukar, et al, (2003), for the ten regions in Ghana, majority of the road accidents occurred in the Greater-Accra Region (32.3%, $n = 8322$), followed by the Ashanti Region (19.3%, $n = 4972$) and Eastern Region (15.2%, $n = 3916$). Together, three regions accounted for two thirds (66.8%, $n = 17,210$) of all the road accidents reported. Further analysis indicated that 61.2% of all fatalities and 52.3% of all road traffic

injuries occurred on roads in rural areas compared to 38.8% fatalities and 47.7% injuries in urban areas. High driving speeds of poorly maintained passenger-ferrying vehicles on generally badly deteriorated roads coupled with lack of emergency medical services, have combined to increase fatalities on the rural roads.

Apart from the sorrow, grief and pain caused by accidents, economic reasons also necessitate the urgent need to reduce road traffic injuries. They consume massive financial and human resources that the country can ill-afford to lose. Recent studies have brought to the fore the socio-economic consequences of non-fatal transport-related injuries in Ghana. In both urban and rural locations, those injured as passengers and pedestrians in motor vehicle crashes tended to have longer disability periods compared with riders and cyclists. The total number of disability days is one way of qualifying the overall societal burden due to non-fatal injuries caused by various modes of transport. The societal burden from transport-related injuries is higher in urban areas than in rural areas. The cost for medical treatment included payments for medical services by the injured persons and their families. In Ghana, hospital fees and supplies are paid for out-of-pocket by patients and their relatives. The out-of-pocket medical payments were estimated to $\$228 \pm \100.05 per transport-related injury in urban areas compared with $\$64.31 \pm \21.09 per transport-related injuries in the rural areas. This further explains why medical payments are shared responsibility of patients and their relatives. The discussions that came out of the findings were that there were consistent increase in the number of road traffic crashes, death and injuries during the period studied (1994-1998).

The Greater-Accra, Eastern, Ashanti and Central regions together accounted for the large number of traffic crashes, fatalities and injuries in Ghana. Apart from the general improvement in accident reporting by the police, such factors like the high concentration of economic activities, the high number of registered vehicles and the long stretches of relatively good highways that pass through towns and villages have engendered the increase in road traffic accidents. Efforts at improving road safety over the years have not succeeded in reversing the upward trends.

Although the crash rate per 100,000 inhabitants was highest in Greater-Accra, the relatively low-speeds of vehicle in the urban environment in Accra, the national capital, gave rise to low 'fatal' and 'serious' injury rate when compared with Eastern and Central regions. Excessive vehicular speeds on Kumasi-Accra and Accra-Takoradi highways, and the fact that they pass through towns and villages in the Eastern and Central regions respectively have contributed greatly to the high fatal and serious injury rates. The roads were planned and executed with accessibility as the main driving force without much consideration to road traffic safety. For example, there is the general lack of measures to facilitate the safe movement of pedestrians. Road signs and markings are woefully inadequate and accident black spot improvement has not been given the due attention that it deserves. The available data did show that there was a preponderance of buses, taxis and trucks involved in road traffic casualties. It was surprising that the percent of trucks all fatalities accounted for by trucks occupants was 10%. This is because trucks are not officially permitted to carry passengers in Ghana.

According to Rockson A. (2005), the spate of lethal lorry accidents on Ghana roads is very alarming. It calls for an investigative study into the causes to be better placed to redress the situation. The adverse effect on the nation economically, losing her precious energetic sons and daughters, financial and psychological strain brought to bear upon the bereaved families, the government and the medical services cannot be over-emphasised. In addition to all the attributed factors, some empirical observations into the causes revealed the following:

1. The blame is squarely put on the heads of the nonchalant drivers who value not their lives let alone that of the passengers, hence resorting to careless driving.
2. Most of the drivers do not understand the code of driving, especially, the white broken and non broken lines on the ground. They overtake vehicles where they are not supposed to.
3. Some of the drivers often attempt to overtake vehicles on upward slope or at bends when they can hardly see 100 metres ahead of them.
4. The most dangerous things drivers do, is their failure to cede or give way to a vehicle that has decided to overtake them. Most often one could see a vehicle hurtling down the same road lane in the opposite direction in a likely head-on clash with the vehicle doing the overtaking but the car being overtaken would not cede passage by slowing down to avoid the looming accident, knowing the other driver can no longer manoeuvre.
5. Most drivers in attempts to avoid potholes take to the tracks of on-coming lanes whether or not they can see ahead of them.
6. Drink driving and over speeding where they lose their senses and the grip at the least provocation of whatever sort.
7. Mechanical problems of the vehicles resulting from lack of maintenance.

8. The corrupt attitude of the police in checking the drivers and their vehicles, accepting bribes and waiving faulty vehicles through.
9. The numerous bad road constructions with innumerable vehicle damage.

3. Methodology

3.1 Data

This data is a monthly returns submitted by the Western Region Branch of Driver and Vehicle Licensing Department (DVLA) in collaboration with National Road Safety Commission (NRSC) and the Motor Traffic and Transport Unit (MTTU). The collection process for these data includes the recording of details about the accident, together with the type of vehicles involved in the accidents.

From the data collected, accidents were grouped into two categories. Serious accidents (where no deaths were recorded) and fatal accidents (where deaths are recorded). The classes of vehicles that were involved in accidents were motor cycles, private vehicles, taxis and hiring cars, light commercial vehicles (buses), heavy commercial vehicles, articulator and timber trucks, tractor and earth moving equipments and bicycles and carts.

In analysing the Distribution of Accidents by Types of Vehicles the accidents which occurred in all the six consecutive years were classified according to the type of vehicles involved to enable us determine the class of vehicles that were more involved in road accidents. The following were considered. Motor Cycles, Bicycles, Carts, etc, were put to one class because of their nature, that is they have two tyres to move on, Private Vehicles on the other hand was separated from the rest of the vehicles because they often perform private duties, Taxis and Hiring Vehicles were classified as one because they are short term service vehicles which are mostly found within their communities, Light Commercial Vehicles/Buses, Heavy Commercial Vehicles, and Heavy Buses were considered under commercial vehicles because they travel longer distances and lastly Articulator Trucks, Tractors and Earth Moving Machines which are good carrying vehicle.

The groups are:

1. Motor Cycles, Bicycles, Carts, e.t.c, (MC&B/C)
2. Private Vehicles (P/V)
3. Taxis and Hiring Vehicles, (T/HV)
4. Light Commercial Vehicles/Buses, Heavy Commercial Vehicles, and Heavy Buses (COMM/V)
5. Articulator Trucks, Tractors and Earth Moving Machines (AT/TEM)

The Chi-Square Tests for Independence was used to test for the differences in the rate of occurrences of accidents. That is, does type of vehicle accidents depend on the period of accidents? The analysis of variance was however used to test for the significant differences among the periods (quarterly) in the average number of accidents.

4. Results

The percentage of distribution of both fatal and serious accidents from 2000 to 2005 showed an upward increase in the number of accident fatalities over the period 2000 to 2005. In the year 2000, the total number of accidents recorded was 2018 out of which 38 (1.98%) were fatal, while in the year 2001, the total number of accidents recorded was 1493 out of which 35 (2.34%) were fatal. Though there was a significant decrease in the number of accidents in 2001 as compared to 2000 (1493 in 2001 and 2018 in 2000), the percentage of fatal accidents increased significantly (35 in 2001 and 38 in 2000). Similarly, in the years 2002, 2003, 2004 and 2005 the number of accidents recorded were 1217, 1054, 1245, and 1113, respectively and their corresponding percentages of fatalities were 1.40, 3.98, 4.34 and 4.85, respectively.

In the year 2000 highest number of accidents was recorded in the month of March (208) and the least in July (130). Out of the 1978 accidents recorded as serious 712 (35.3%) involved Taxis and Hiring Vehicles.

It was also observed that in the year 2001 there was a high significant reduction in the number of accident recorded as compared to the year 2000 (25% reduction) however, the fatality rate was almost the same for both years. The highest number of accident recorded involved private vehicles.

It can also be seen from the table that the highest number (11) of accidents occurred through Motor Cycles was in February, likewise that of Heavy Commercial Vehicles (13) while that of Private Vehicles was in March (64). The highest number of accidents for Taxis and Hiring Vehicles was in December (43), that of Light Commercial Vehicles was in November (22) and Heavy Buses was in July (20). In all the month of December recorded the highest (143) number of accidents whilst April had the least (95).

In the year 2000 Private Vehicles (25.52%) Taxis and hiring Vehicles (35.28) contributed to the highest number of accidents. Also the highest number of accidents occurred in March (10.31%) and May (9.96 %).

In the year 2001 Private Vehicles (34.76%) Taxis and hiring Vehicles (22.91) contributed to the highest number of accidents. Also the highest number of accidents occurred in March (9.65%) and December (9.58 %).

In the year 2002 Private Vehicles (29.25%) Taxis and hiring Vehicles (23.09) and Light Commercial Vehicles (19.96%) contributed to the highest number of accidents. Also the highest number of accidents occurred in January (12.40%) and the least was in April and September.

Private Vehicles (33.20%),Taxis and Hiring Vehicles with (24.38%) Light Commercial Vehicles and Buses (22.38%) accounted for most of the occurrences in year 2003. The month of April (10.62%) recorded the highest number of accidents.

Private Vehicles recorded the highest (32.69 %) followed by Taxis and Hiring vehicles (23.45%) and then Light Commercial Vehicles (20.08%). The distribution of recorded accident for the various month were almost the same in the year 2004

The situation is not different in the year 2005, where Private Vehicles recorded the highest (34.14 %) followed by Taxis and Hiring vehicles (22.10%) and then Light Commercial Vehicles (18.15%), however the month of December recorded the highest number of accident cases.

4.1 Testing for Independence among the Type of Vehicles and Period of Accidents

HYPOTHESES

The null hypothesis, H_0 , and the alternative hypothesis, H_a , being tested are:

H_0 : Type of vehicles involved in accidents are independent of the period of occurrence.

H_a : Type of vehicles involved in accidents are not independent of the period of occurrence.

| Statistics | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---------------------|------|------|------|------|------|------|
| Chi-Square Stats | 43.3 | 18.7 | 54.5 | 20.5 | 24.3 | 36.7 |
| Chi-Square Critical | 21.0 | 21.0 | 21.0 | 21.0 | 21.0 | 21.0 |

The table above represents the results the chi square analysis for the year 2000 to 2005. The test statistic was found to be 43.3, 18.7, 54.5, 20.5, 24.3 and 36.7 for year 2000, 2001, 2002, 2003, 2004 and 2005 respectively. At 0.05 significance level we reject the null hypothesis of year 2000, 2002, 2004 and 2005 since their chi square statistics were higher than the chi-square critical. We therefore concluded that the type of vehicles involved in accidents is not independent of the period of occurrence for the years 2000, 2002, 2004 and 2005

Four out of the six years of the accident data under study showed some level of dependency in between the type of vehicle and the period of occurrence. We therefore conclude that the type of vehicle involved in accidents and the period of occurrence is dependent

4.2 Analysis of Variance of Quarterly Means

In this section, we conduct an analysis of variance of quarterly means of accident data. In one-way analysis of variance, the interest lies on the null hypothesis that the category means are equal in the population. In other words,

$$H_0: \mu_1 = \mu_2 = \mu_3 = \dots = \mu_c$$

$$H_1: \mu_i \neq \mu_j \text{ for some } i \text{ and } j$$

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|------------|-------|-------|-------|-------|-------|-------|
| F-cal | 4.12 | 0.11 | 0.06 | 0.11 | 0.08 | 0.13 |
| F-Critical | 3.24 | 3.24 | 3.24 | 3.24 | 3.24 | 3.24 |
| P-value | 0.024 | 0.955 | 0.980 | 0.953 | 0.969 | 0.130 |

It is observed from the table that for 3 and 16 degrees of freedom, the calculated value of F at $\alpha=0.05$ for the years 2000, 2001,2002, 2003, 2004, and 2005 were 4.12, 0.11, 0.060, 0.110, 0.080 and 0.130 respectively. We fail to reject the null hypothesis for the year 2001 to 2005 since their F- cal is smaller than the F- critical. This can also be compared with the P- values. We therefore conclude that the means of the accidents recorded for the four quarters in 2000 are indeed not different.

5. Summary

The study analyzed accidents data in the Western region of Ghana spanning the period 2000 to 2005. The reported accident data was obtained from the Driver and Vehicle Licensing Authority and the Motor Traffic and Transport Unit of the Ghana Police Service, Takoradi. The data covers the following categories of vehicles: taxis and hiring vehicles, motor cycles, private vehicles, light commercial vehicles, heavy commercial vehicles, heavy buses, articulator trucks, earth moving equipments, bicycles, carts, etc.,. This study was conducted to investigate whether the rate of accidents in the Western region of Ghana varied from one quarter of the year to the other. It was also to investigate which type of vehicles were commonly involved in accidents. The data was initially explored for interesting features.

5.1 *Serious and Fatal Accidents*

Generally, the rate of fatal accidents recorded from year 2000 to year 2005 increased steadily, though in year 2001 the recorded number of fatal accidents was more than in the year 2002. Similarly the rate of serious accidents decreased steadily from the year 2000 to year 2005, though the year 2002 had a higher number of recorded serious accidents than in the year 2001. Apart from the year 2000 in which taxis and hiring cars recorded the highest accident rate, private vehicles recorded the highest number of reported accidents in the rest of the years, i.e. 2001-2005..

5.2 *Periods of Accidents and the Types of Vehicles Involved*

As stated in Chapter Three, the vehicles were grouped into five categories. Preliminary analysis shows that private vehicles recorded the highest number of accidents followed by commercial vehicles during the period under study. Most of the accidents also occurred in the month of March followed by the month of April. Most of the accidents were recorded in the first and fourth quarters of each year, but majority were recorded in the first quarter which falls within the festive season i.e. Easter Holidays.

5.3 *Test for Independence*

Further analysis was conducted on the data to find whether the type of vehicles involved in accidents and the period of accident were independent. The test revealed some interesting features; about 67% of the test conducted showed that the period of accidents and the type of vehicle involved were not independent. It also revealed that the type of vehicles involved in accidents and the year of occurrences are not dependent.

5.4 *Test for Differences between Annual Means of the Number of Accidents*

Analysis of variance was conducted to investigate whether the mean number of accidents varied or remained constant throughout the years. It was found out that apart from the year 2000 in which the null hypothesis was rejected, from the year 2001-2005 the null hypothesis was accepted indicating that the mean accident rate over the years under study are not different.

6. Discussion

In collecting the data from the Driver and Vehicle Licensing Authority, attempt was made to assess the data at the Motor Traffic and Transport Unit of the Ghana Police Service to cross check if there were some discrepancies in collecting of the data. In organising the project, a few interviews were conducted with some of the Insurance Companies. A case in point is accident involving two or more commercial vehicle drivers or taxis and hiring drivers. They revealed that most of the commercial vehicles, taxis and hiring vehicles do not report their accidents to the police; rather those involved, settle the problem among themselves. The explanation was that when the accidents are reported to the appropriate authorities, it takes a longer period for the problem to be solved. This may account for the high rate in reported accidents for private vehicles. It is however recommended that in future, the causes of accidents must be included in the data to help determine the major factors that contributes to accidents in the region.

7. Conclusions

The study revealed that private vehicles contributed to most of the accidents recorded from the period 2000-2005. After grouping the vehicles, it also revealed that private vehicles were among the most occurring accidents for that period as well as commercial vehicles.

Generally, since the accident rate was reducing from the year 2000 to 2005, one may say that the improvements in the road networks in the Western region have contributed to this. Also most of the accidents were recorded in the first and fourth quarters which are in the festive season range. Bicycles, carts, motor cycles, articulator trucks and earth moving equipments were the least contributors to the number of recorded road accidents. In addition the report revealed that the type of vehicle and the period of occurrence is not independent. In certain months, earth moving equipments failed to record any accidents

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