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Assessment of Incident of Road Traffic Accident along Yola Gombe Route

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ABSTRACT: Road traffic accident has become a prevalent and re-occurring phenomenon in Nigeria which constitutes a menace in modern times. Although all the developed and developing countries have suffer from various degrees of road accidents the developing countries clearly dominates with Nigeria having the second highest road accident among the 193 ranked countries of the world. This research aimed at identifying and assessing road accident hot spots between 2012 and 2016 along Yola/Gombe road. Data was collected from the accident hot spots using GIS/GPS techniques. The data was used to map out these accident hot spots. It also assessed the nature, mode of occurrence and types of injuries associated with the accidents within the study area. It further assesses the types and condition of the vehicle with the highest involvement in the accident within the study area.. GIS and Remote sensing method were used to analyse and georeference the map by throwing the coordinates of the accident hotspots that were picked and Data was also collected from Federal Road Safety Commission. These were analysed statistically. Result was used in this research. The study shows that between 2012 and 2016 about 2846 accidents were witnessed, 1,027 people died, 9017 people sustained various degrees of injuries and 3,384 vehicles were involved in the accidents. The causes of accident were observed. The preventive measures were suggested. The study recommended the need to seriously view road traffic regulations seeing them as human induced problem that demand an urgent attention. Such action is aimed at preventing untimely deaths, social, and economic losses and impacts on average Nigerians.

KEYWORDS: Accident, Road, GIS, Remote Sensing

INTRODUCTION

Road Traffic Accidents are the major causes of violent death in our contemporary society and also have high cost on the economy. Among all accidents, road traffic accidents claim the largest toll on human life and tend to be the most serious problem world over (Kuo, 2011). Worldwide, the number of people killed in Road Traffic Accidents (RTAs) each year is estimated at almost 1.5 million while the number of people injured could be as high as 50 million. Currently, Road Traffic Accidents rank 9th in order of causes of death and are projected to rank 3rd by the year 2020 (WHO, 2004).

Accident is defined as anything which happens by chance, anything occurring unexpectedly and un-designed (Odugbemi, 2010). Road traffic accident is a collision or similar incident involving a moving vehicle, resulting in property damage, personal injury or death (Astrom, Kent, Jovi, 2006). Road traffic accident is an unexpected phenomenon that occurs as a result of the use or operation of vehicles including bicycles and handcarts on the public highways and roads. Accidents may be fatal, resulting in deaths of the road users (passengers, drivers or pedestrians), or minor when it is not severe enough as to cause substantial hardship (Sarin, 2000)

Transportation problems faced by various nations have increased manifold, necessitating search for methods or alternatives that ensure efficient, safe, feasible and faster means of transport. A significant unexpected outcome of transportation systems is road accidents which result to injuries and loss of lives. (Sarin, 2000)

There is no universally accepted definition of a black spot. According to Hauer (1996) some researchers rank locations by accident rate (accidents per vehicle kilometres or per entering vehicles), some use accident frequency (accidents per km year or accidents per year) and some use a combination of the two. More recently, the proportion of accident types considered susceptible to treatment is also used for ranking. Another dimension of diversity in practice is that rank may be determined by the magnitude (either of rate or of frequency) or, as is more common, by the amount of the rate or frequency exceeds which is normal for such sites.

Assessment of Incident of Road Traffic Accident along Yola Gombe Route

According to The Bureau of Transport and Regional Economics of Australia (2001) locations are in general classified as black spots after an assessment of the level of risk and the likelihood of an Accident occurring at each location. Sites with potentially hazardous features are sometimes described as grey spots. Based on survey by Sayed and Abdulwahab (1995), the number of accident is affected by three factors.

(i) The road environment

(ii) The condition of vehicles using the road system the skills and concentration

(iii) The physical state of road

This research considers some mechanical, human and environmental factor that causes accident.

In recent years, the number of studies using diverse tools for analyzing accidents and road design has increased considerably. Among these tools, Geographical Information Systems (GIS) and remote sensing stand out for their ability to perform complex spatial analyses. The advancements in GIS and GPS have been put to effective use in accident analysis. In addition to promoting linkage between various types of data and maps GIS is able to manipulate and visually display numerous types of data for easy comprehension. GIS is a technology for managing and processing location and related information. It visually displays the results of analyses thus enabling sophisticated analysis and quick decision making. Development of a system that uses GIS to analyze traffic accidents has been pursued towards improving the efficiency and effectiveness of traffic accident countermeasures. Also GIS would make analysis less time consuming and less tedious which otherwise would become very labour intensive. Thus GIS will offer a platform to maintain and update accident record database and use it for further analysis.

Road accidents do not simply happen, they are caused. Given the fact that Nigeria has the highest road accidents rate as well as the largest number of death per 10,000 vehicles, (Sheriff, 2009).There is the need to evaluate and map the areas where these accident are occurring in order to avert their occurrence.

Road Traffic Accidents are having a serious effect on our society and economy. Among all accidents, road traffic accidents claim the largest toll of human lives and tend to be the most serious problem worldwide (Kuo, 2011).The number of people killed in Road Traffic Accidents (RTAs) each year is seriously alarming and the number of people injured is also disturbing. Currently, Road Traffic Accidents has been ranked 9th in order of causes of death and are projected to rank 3rd by the year 2020 (WHO, 2004).

The pattern of road accidents in Nigeria seems to suggest that the better the road, the higher the accident and fatality rate as well as the severity and non-survival indices because of drivers‟ non-compliance with speed limits (Filani & Gbadamosi, 2007). Studies have also shown that most accidents in Nigeria today occur on federal roads and the roads topping the list include Benin-Ore, Lagos-Ibadan Expressway, Abuja-Lokoja-Okene, Kaduna-Zaria-Kano, Okigwe-Umuahia, Kaduna-Abuja, Enugu-Awka-Onitsha and Otukpa among others (Godwin, 2012) In most of the studies carried out on Road Traffic Accidents in Nigeria, different methodologies were employed to examine the causes, pattern, trend and the effect of road traffic accident in Nigeria.

Although, none of these studies (Bennett, 2010; Rankavat and Tiwari, 2013; Aworemi and Abdul-Azeez 2010; Aderamo 2012; and Umar 2009) have attempted to analyze Road Traffic Accident hotspots between Yola and Gombe expressway in particular or assessing the nature of road accident. Therefore this study intends to assess road traffic accident between Yola and Gombe using various GIS techniques.

The aim of this research is to identify and assess road traffic accident hot spots between 2012 and 2016 along Yola to Gombe with the view of finding lasting solution to the accident problem. The aim of this study was achieved through the following objectives:

- To map road traffic accident hotspot along trunk A road between Yola and Gombe from 2012-2016.
- To assess the mode, nature of occurrence and type of injuries associated with road accident along this area.
- To assess the types and condition of vehicles that have the highest involvement in accident along this road.
- To create an alternative route that will be cost effective and safer for road users.

MATERIAL AND METHOD

This study covers a total length of 230 kilometers. It is a federal road and is located between Yola and Gombe. Yola is located on latitude 09^0 14'N and 9^0 20'N and longitude $12^0$25'E and $12^0$28'E. and Gombe is situated between latitude 10°15'N and 10^o25 longitude 11°10'E and 11^o16 of the Greenwich meridian (figure 1).

The study area comprises of sedimentary deposit within the rift and volcanic. The sedimentary deposits occupy the rift that runs eastward from Kaltungo area. The rift accumulated sediment of different strata graphic units which were involved in two deformation episodes during Cenomanian and Santonian ages that lead to distended structures of Lamurde, Gwonba-Tambo, Bagale-Gagare and Kiriwari anticlines lying adjacent to Dadiya ,Burong, Girei, and Fufore syncline alternatively. The unit formed

the Kiriwari, Bagale and Gagare hills. The second unit of deposit is Yolde formation. It consists of ancient beach deposit of cenomanian age and outcrop extensively around Lafiya Lamurde area.

The major vegetation in the states is savannah vegetation type, which is dominated by guinea savannah and Sudan savannah.

The data used for this study include: Google Earth imagery with spatial resolution of 1m was acquired and route for the study area was extracted. GPS was used to collect the coordinates of the accident locations. The DEM of the study area was extracted from shuttle radar topographic mission data using ArcGIS version 10.1 was used to create the relief map using the 3D analyst tool. Accident record from Federal Road Safety Commission. The data collected include the following:

a) Date of accident
b) Location/route of accident
c) Number of vehicle involved
d) Type of vehicles involved
e) Type of accident (fatal, severe or minor)
f) Causes of accident
g) Number of people involved in the accident

The data from the Federal Road Safety Commission, the coordinates of the accident and the characteristics of the road was used for creation of the database.

The instrument used are**:** ArcGIS 10.1(for cartographic modelling), Microsoft Word (for word processing), Microsoft Excel (for data presentation of charts),Hand held Germin GPS for data capturing/collection ,Colour printer (for colour graphics),Scanner(for data input) and PC System.

RESUILTS AND DISCUSSIONS

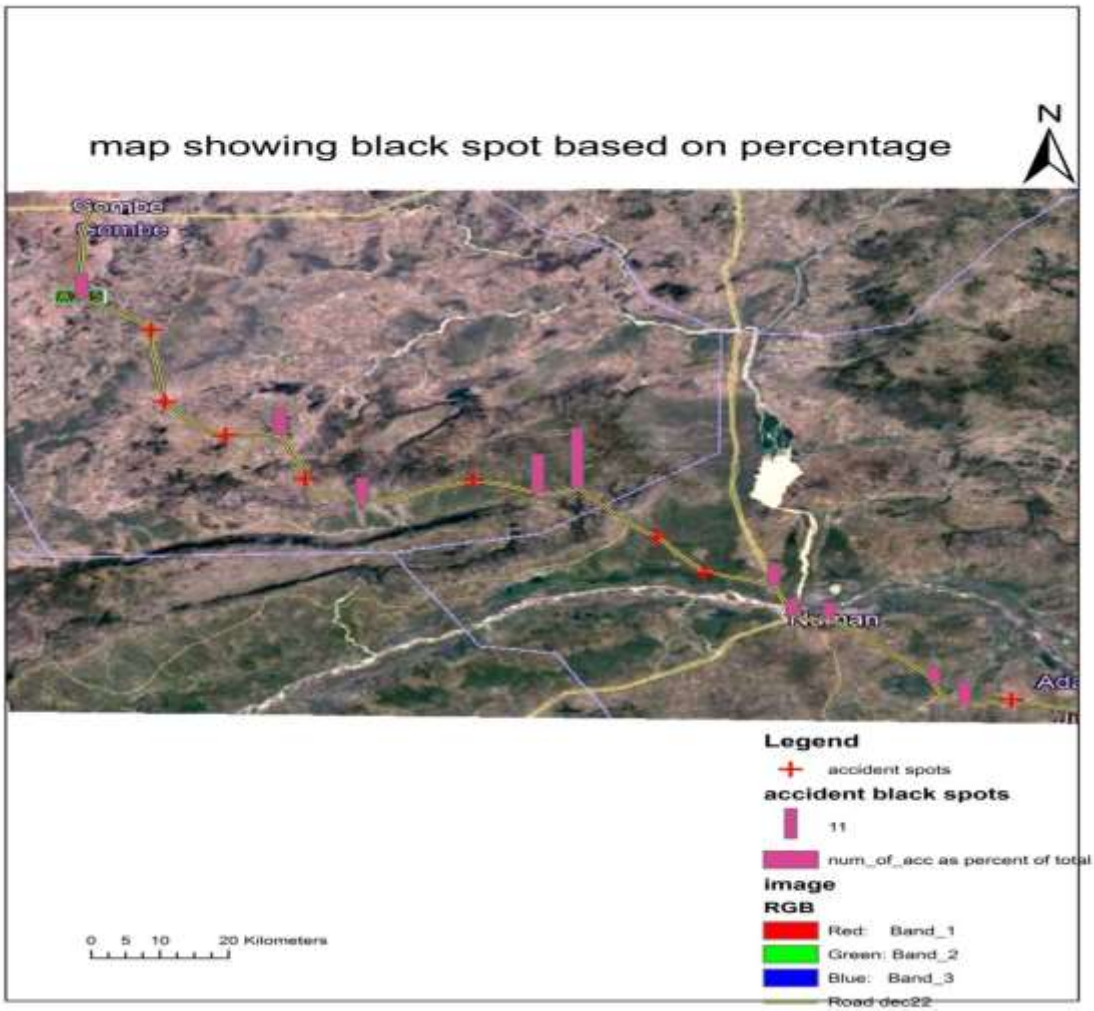


Fig.1.map showing accident black spots

Source: Author's work

Assessment of Incident of Road Traffic Accident along Yola Gombe Route

Table 1.total accident record from 2012-2016

YEARS	2012	2013	2014	2015	2016	Total
RTC	708	684	541	443	465	2841
KILLED	196	226	217	183	205	1027
INJURED	1929	2318	1876	1387	1507	9017
VEHICLE INVOLVED	620	400	881	715	768	3384

Source: Federal Road Safety Head Quarter Adamawa State

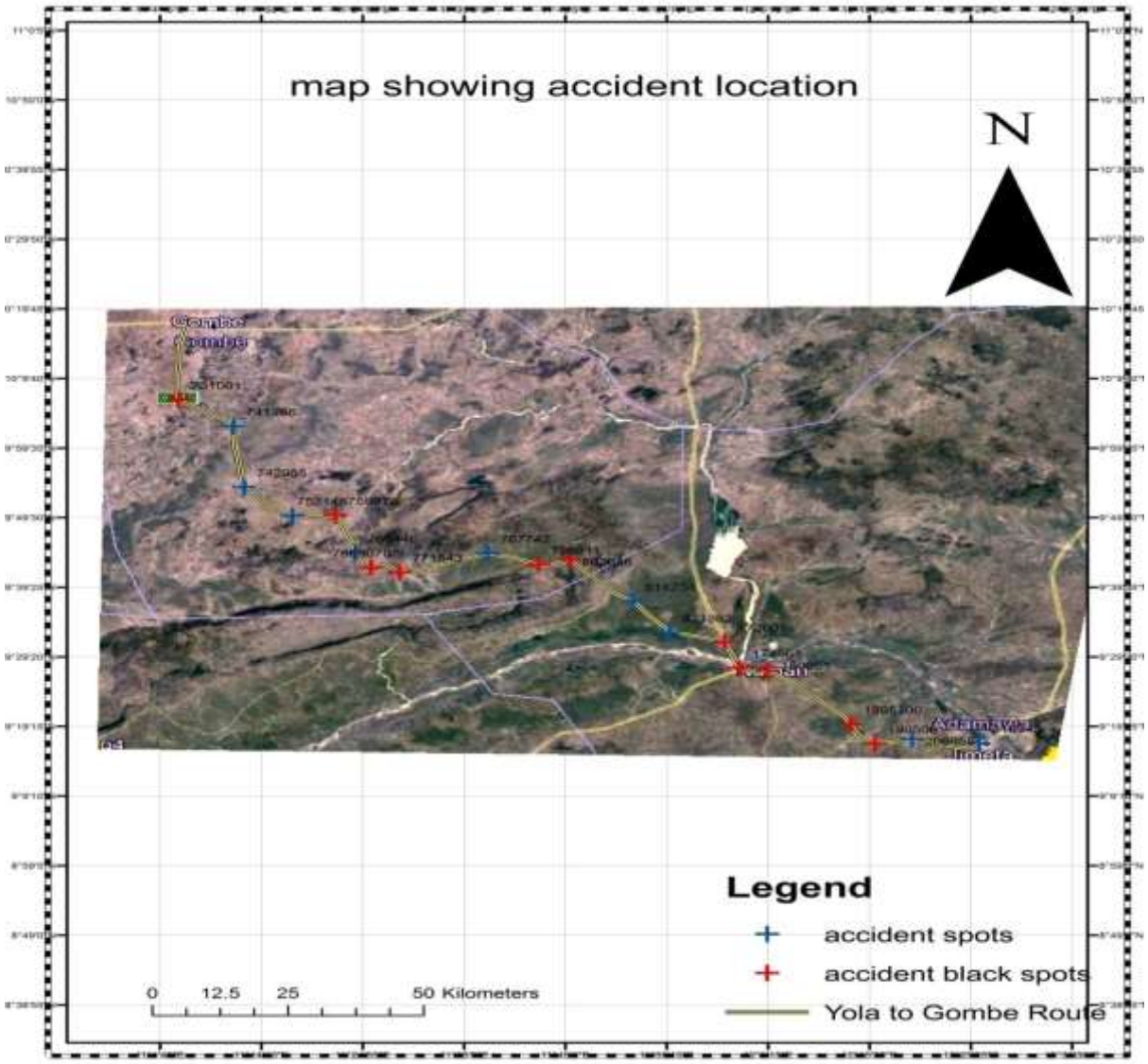


Fig2. Map showing accident location

Kernel density analysis

Kernel density analysis is used to find the accident probability zone by using accident hot spot information. The probability zones are classified into High, Medium, and Low. It displays the dangerous zone in red Colour

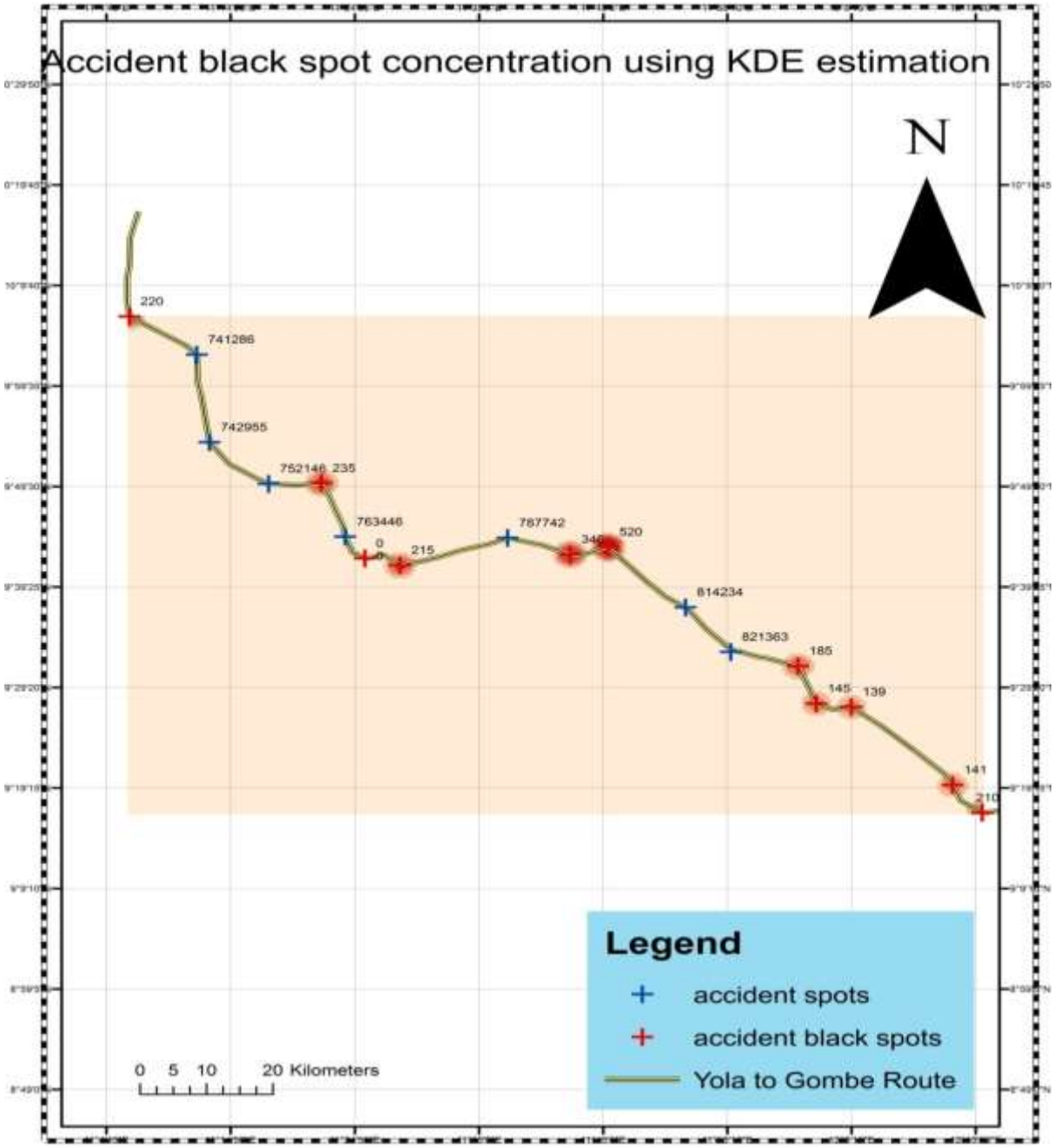


Fig.3. map showing areas of high concentration of accident using KDE
Source: Author' work 2017

Table.2. accident record of 2012

2012(month)	T/ACC	KILLED	INJURED	V/INVOLVES
JAN	41	13	108	60
FEB	60	10	117	68
MARCH	69	16	150	77
APRIL	103	25	208	117
MAY	72	17	185	76
JUNE	42	14	110	34
JULY	56	21	138	46
AUGUAST	52	16	151	38
SEPT	39	10	118	23

OCT	64	17	206	34
NOV	55	8	198	31
DEC	55	29	240	16
TOTAL	708	196	1929	620

Source: Federal Road Safety Head Quarter Adamawa State

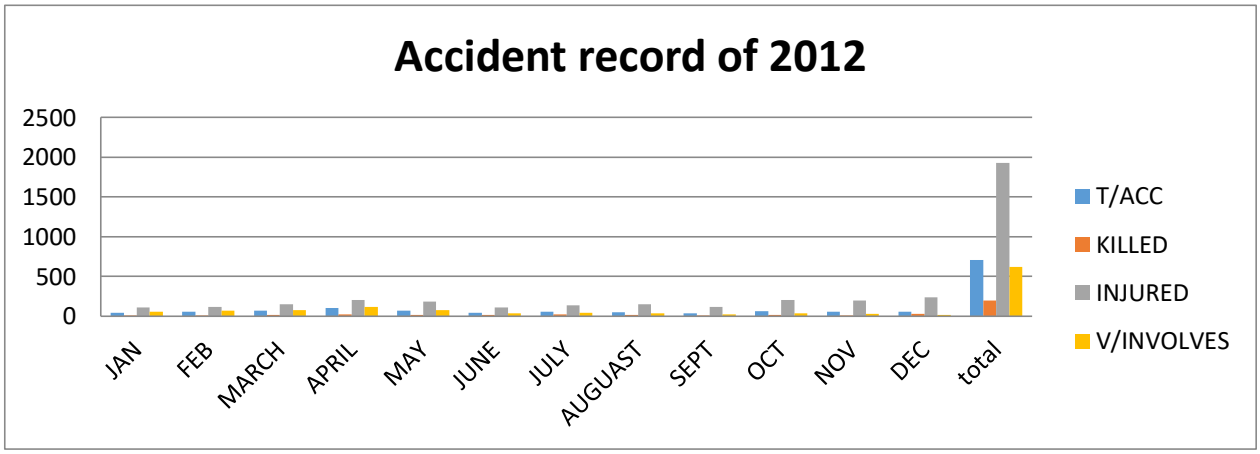


Fig.4 Graph showing 2012 accident record

Table 4. Accident record of 2013

2013(months)	T/ACC	KILLED	INJURED	V/INVOLVES
JAN	47	27	223	33
FEB	57	9	191	38
MARCH	57	20	169	33
APRIL	59	17	203	37
MAY	63	24	193	20
JUNE	43	12	123	25
JULY	58	10	169	36
AUGUAST	57	13	161	34
SEPT	58	24	187	44
OCT	52	15	188	34
NOV	53	14	149	28
DEC	80	41	362	38
TOTAL	684	226	2318	400

Source: Federal Road Safety Quarter Adamawa State

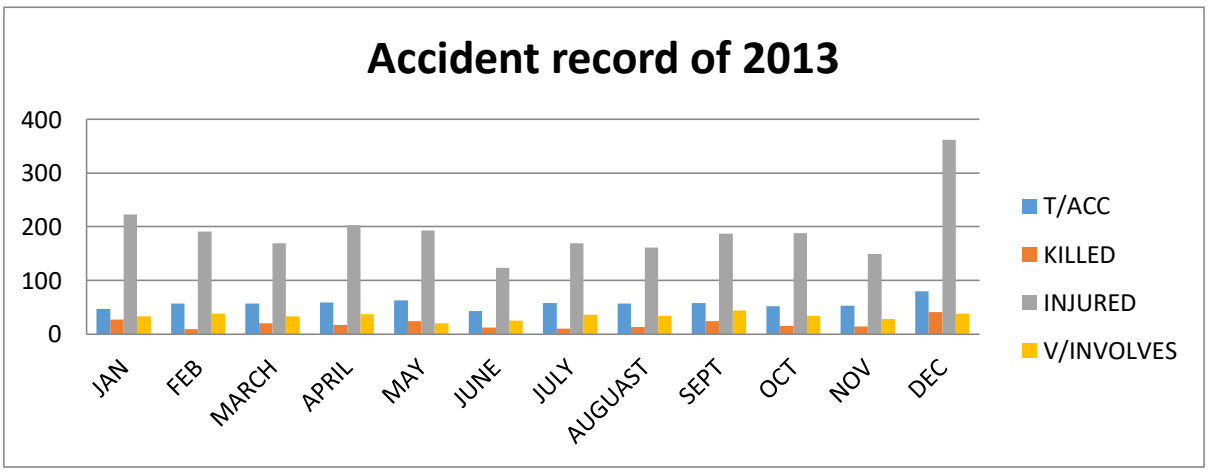


Fig.5.Graph showing accident record of 2013

Table 5. Accident record of 2014

2014(months)	T/ACC	KILLED	INJURED	V/INVOLVES
JAN	75	26	245	102
FEB	45	29	201	61
MARCH	43	24	95	64
APRIL	30	4	52	49
MAY	52	22	178	82
JUNE	41	18	156	76
JULY	23	4	65	41
AUGUAST	52	20	203	84
SEPT	39	13	116	63
OCT	53	19	175	95
NOV	44	19	195	82
DEC	49	19	195	82
TOTAL	546	217	1876	881

Source: Federal Road Safety Quarter Adamawa State

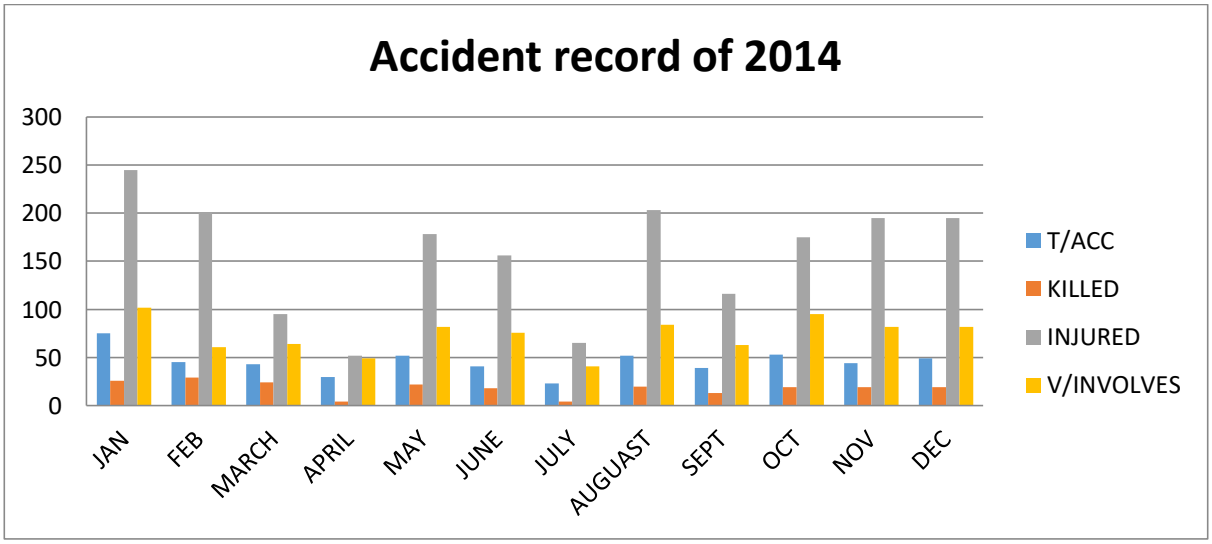


Fig 6.Graph showing accident record of 2014

Table 6.Accident record of 2015

2015(months)	T/ACC	KILLED	INJURED	V/INVOLVES
JAN	32	4	83	50
FEB	28	23	129	56
MARCH	44	10	139	75
APRIL	31	15	93	48
MAY	42	8	157	66
JUNE	29	18	65	46
JULY	29	13	76	47
AUGUAST	34	8	85	47
SEPT	38	26	130	59
OCT	44	19	116	72
NOV	42	19	101	72
DEC	50	20	213	77
TOTAL	443	183	1387	715

Source: Federal Road Safety Quarter Adamawa State

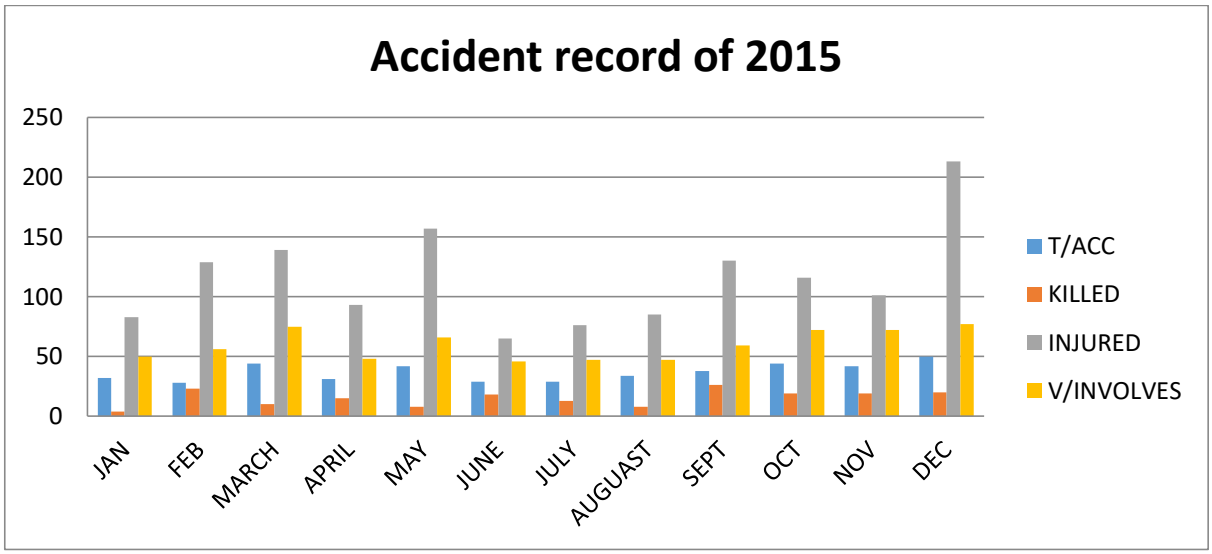


Fig 7.Graph showing accident record of 2015

Table 7. Accident record of 2016

2016(months)	T/ACC	KILLED	INJURED	V/INVOLVES
JAN	47	25	177	89
FEB	46	49	145	79
MARCH	42	8	95	65
APRIL	32	12	93	47
MAY	41	6	150	64
JUNE	33	13	103	53
JULY	30	11	90	52
AUGUAST	33	9	92	55
SEPT	34	8	132	54
OCT	36	11	98	56
NOV	40	5	100	72
DEC	51	48	232	82
TOTAL	465	205	1507	768

Source: Federal Road Safety Quarter Adamawa State

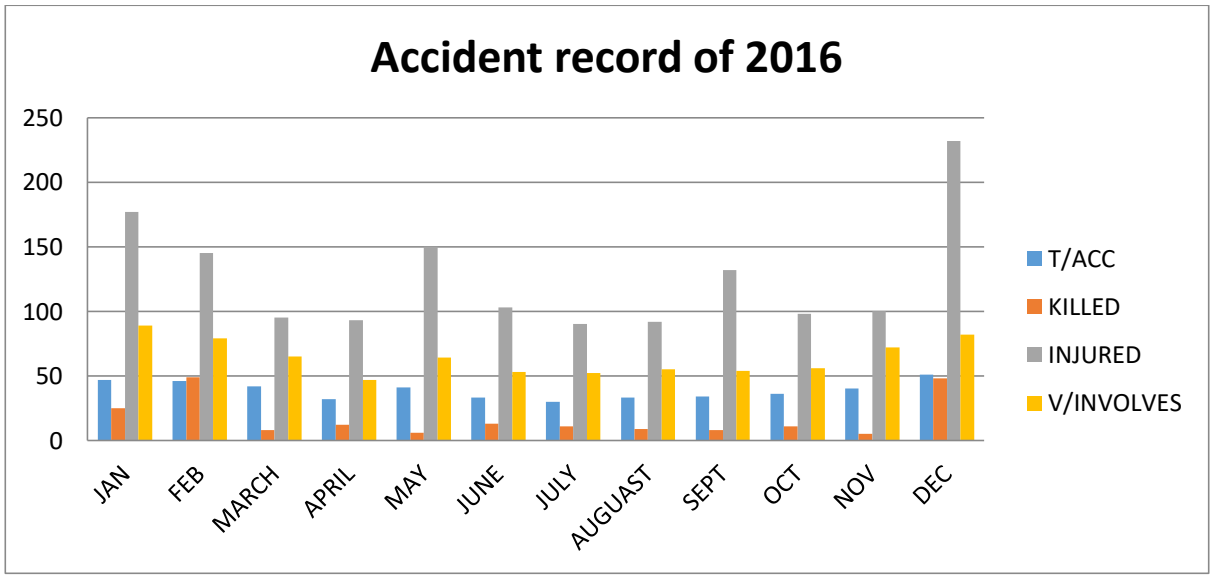


Fig 9. Graph showing accident record of 2016

ANALYSIS OF NATURE OF ACCIDENT

On the basis of the data collected total of 10461 accidents had occurred. Deaths, injuries have taken recorded. It is observed that nearly 52.481% injuries are grievous, Fatal (Death) accident recorded is (9.817%),minor injuries is 37.707%, based on the recorded at least 17 people died every month. These figures clearly show that number and accidents occurring between Yola to Gombe route are high. There is an urgent need to carry out proper traffic management studies in order to regulate the accident rate. Further, it can be seen that most accident prone area are as a result bends, and the steepness of the terrain In the last 5 years, total of 10461 accidents of different types have occurred. Out of this, 10461 accidents have lead to grievous injuries (52.481%).

Table 10.showing record of Nature of accident from 2012-2016

Nature of accident	2012	2013	2014	2015	2016	total
Fatal	196	226	217	183	205	1027
Grievous	1406	1183	1097	809	995	5490
Minor injuries	940	1135	779	578	512	3944
total	2542	2544	2093	1570	1712	10461

Source: Federal Road Safety Quarter Adamawa Stat

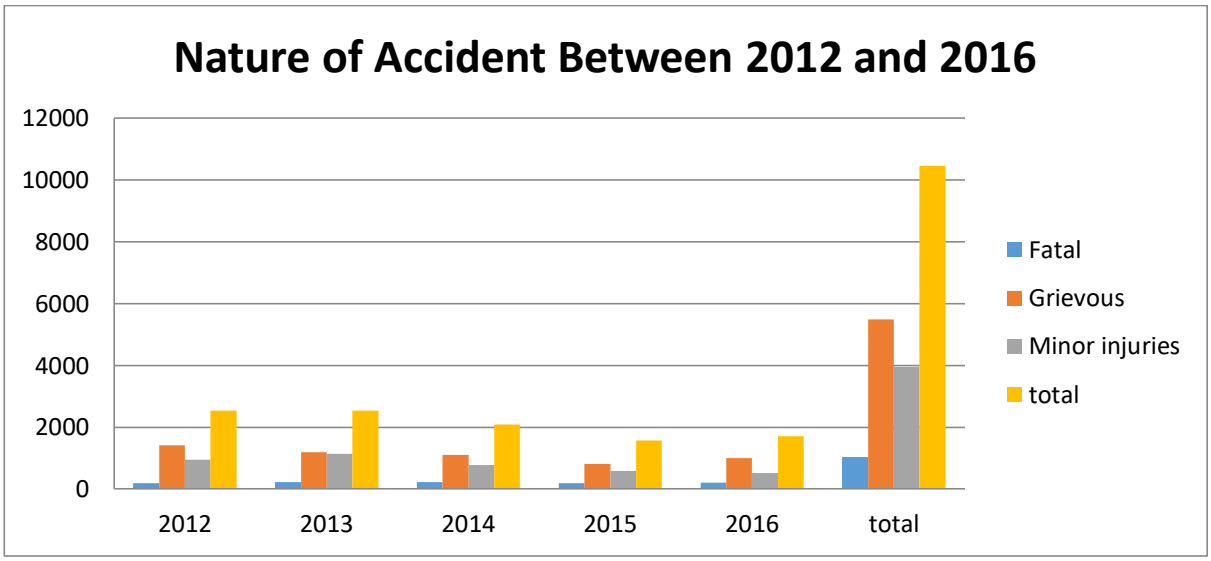


Fig 10.Graph of Nature of accident from 2012-2016

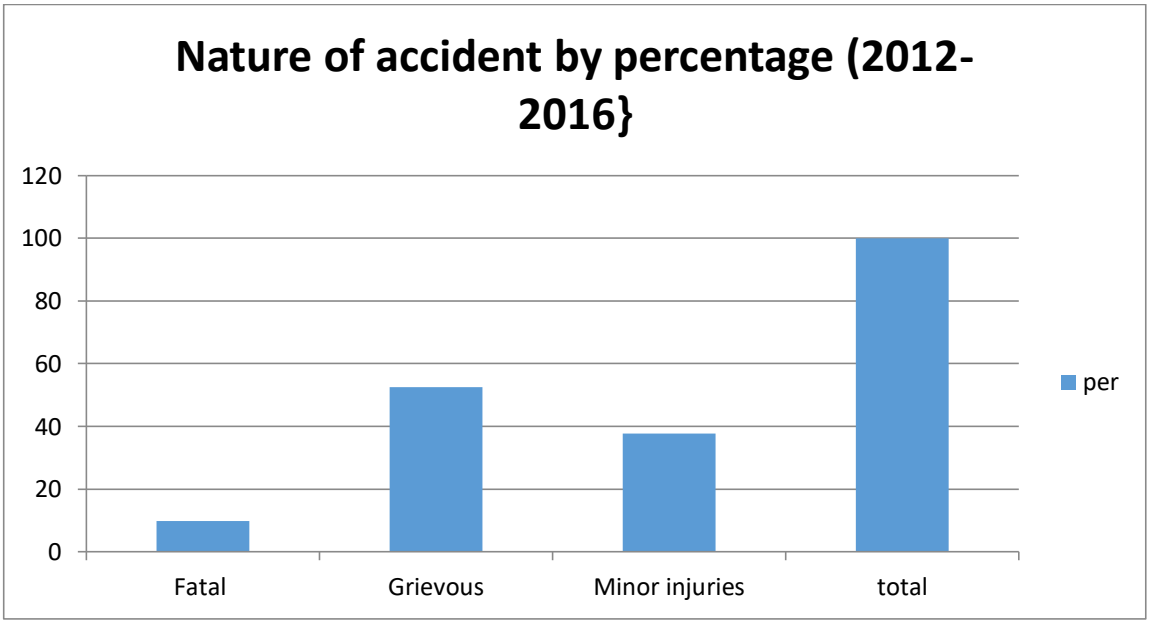


Fig 11.Graph of Nature of accident by percentage from 2012-2016

Assessment of Incident of Road Traffic Accident along Yola Gombe Route

Based on the recorded data bad road had caused the highest number of accident to about (34.72%), reckless driving caused (28.92%),inexperience (13.98%),mechanical fault (13.53%),pedastrial crossing(5.62%),unknown causes(3.23%).

Table12. Record of causes of accident from 2912-2016

Causes of accident	2012	2013	2014	2015	2016	total
Reckless driving	195	182	178	152	116	823
Inexperience	110	98	66	51	73	398
Mechanical fault	92	76	71	81	65	385
Pedestrian Crossing	40	50	23	20	27	160
Bad road	250	236	201	130	171	988
Unknown causes	21	42	7	9	13	92
total	**708**	**684**	**546**	**443**	**465**	**2846**

Source: Federal Road Safety Quarter Adamawa State

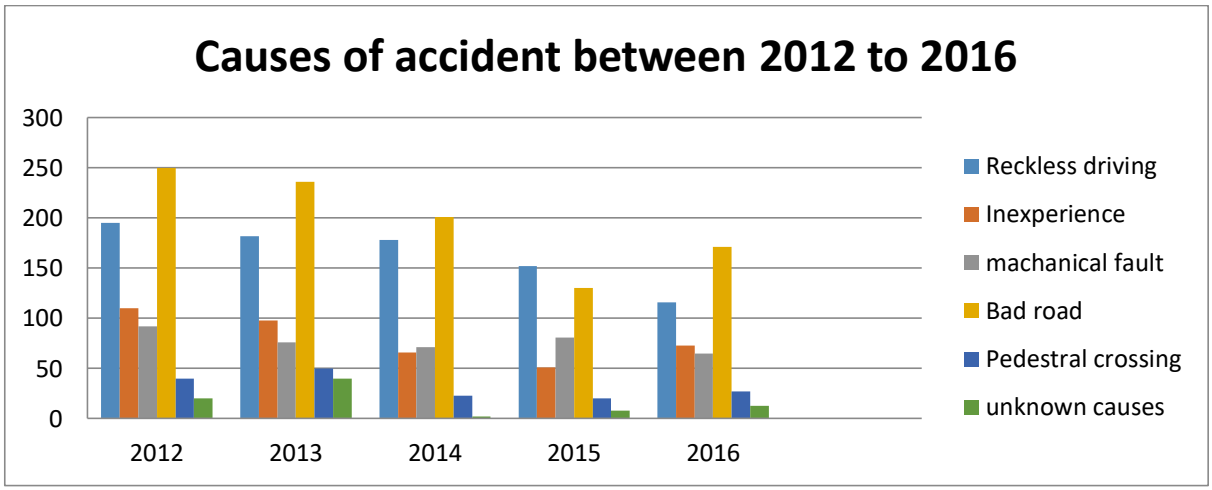


Fig 12.Graph showing causes of accident from 2012-2016

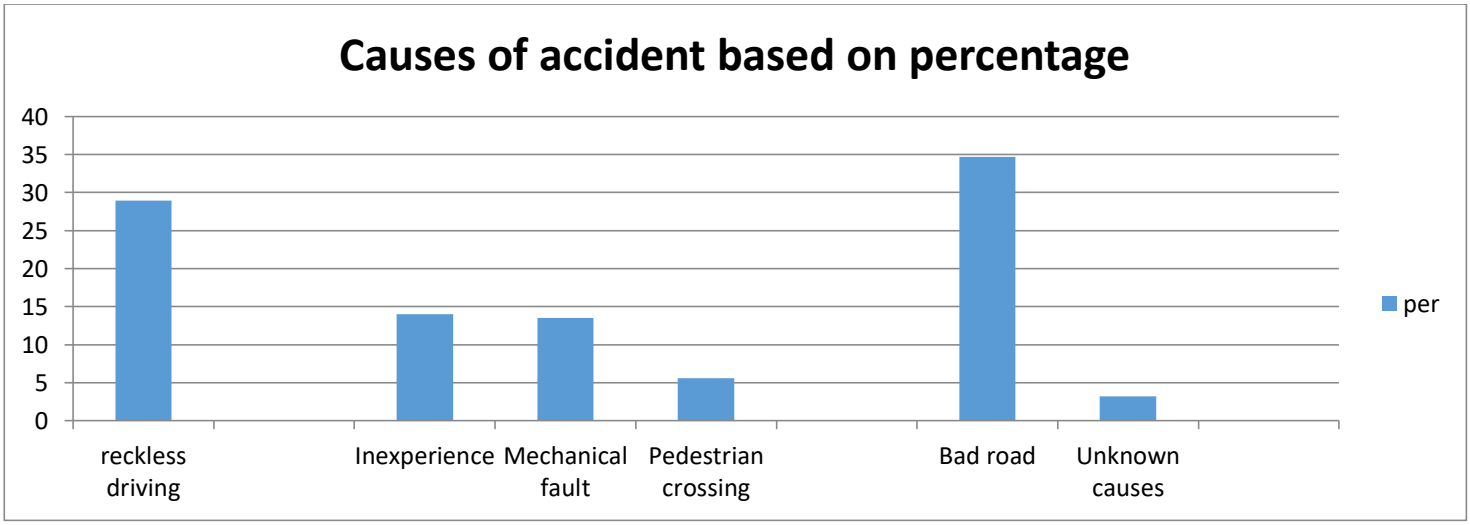


Fig 13.showing causes of accident based on percentage

Table 13.Total accident record from 2012-2016

years	2012	2013	2014	2015	2016	Total
T/A	708	684	546	443	465	2846

Assessment of Incident of Road Traffic Accident along Yola Gombe Route

KILLED	196	226	217	183	205	1027
INJURED	1929	2318	1876	1387	1507	9017
VEHICLE INVOLVED	620	400	881	715	768	3384

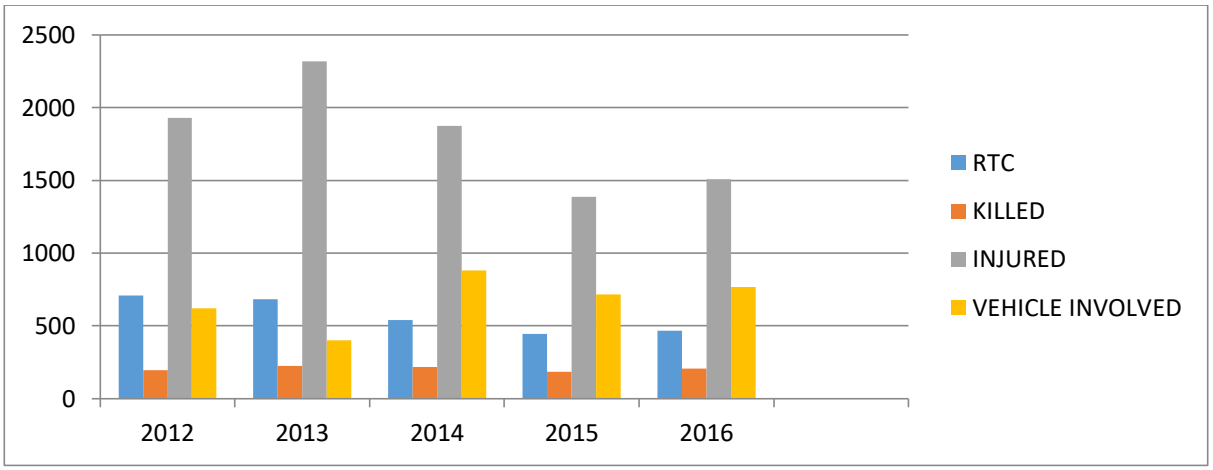
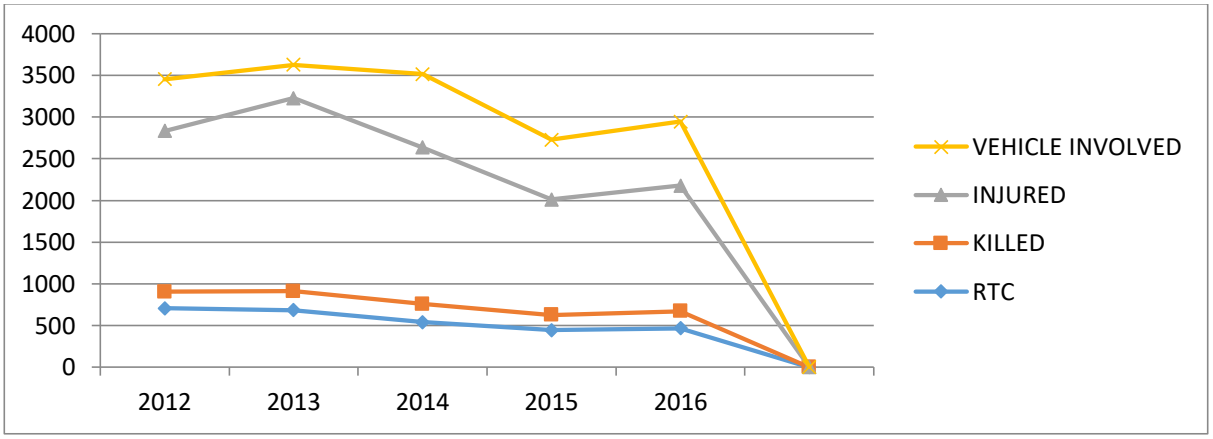


Fig14.Graph showing total record of accident of 2012 to 2016



Accident Analysis on Monthly Basis:

Here the database has been queried for accidents as per month for the year 2012-2016 using ARC GIS. This query Yield results for accidents occurring in each month for the years2012-2016. It is clearly seen that the maximum number of accidents occurred at Yola to Gombe route in the months of December. This could be due to large number of vehicles travelling for charismas and New Year celebration. Also in the months of December, February and January the fatality rate is high especially in December followed by February and January in all the five period of years.

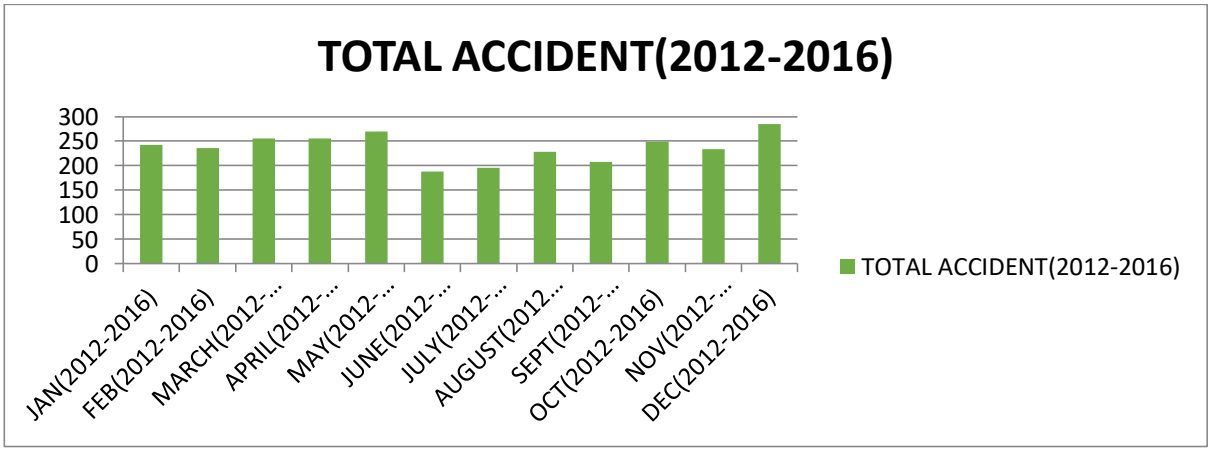


Fig 15. Total Accident record from 2012-2016

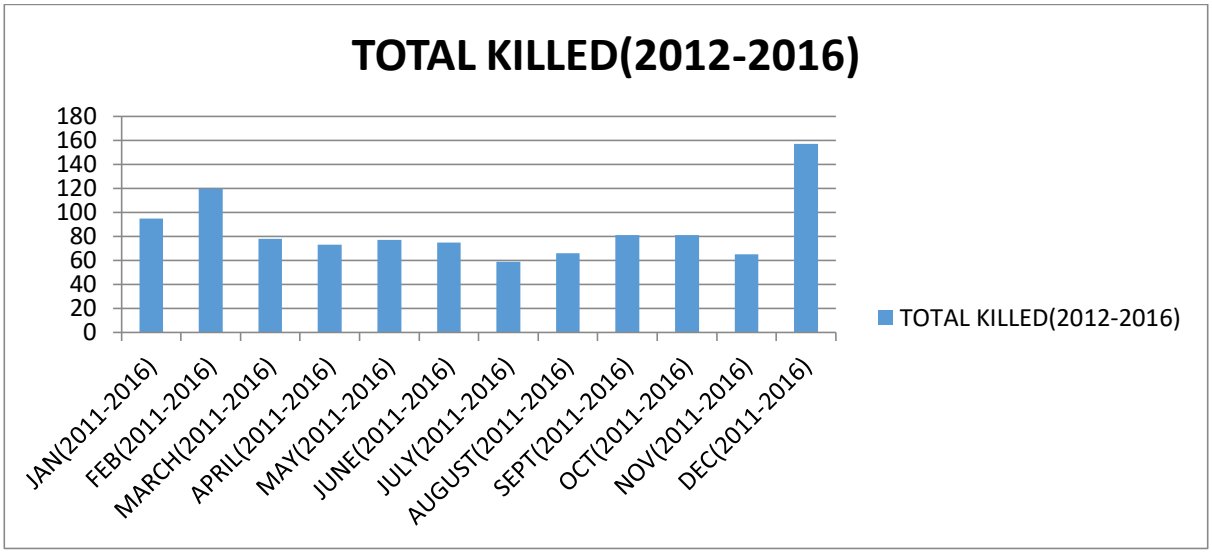


Fig 16. Graph of total people killed by accident from 2012-2016

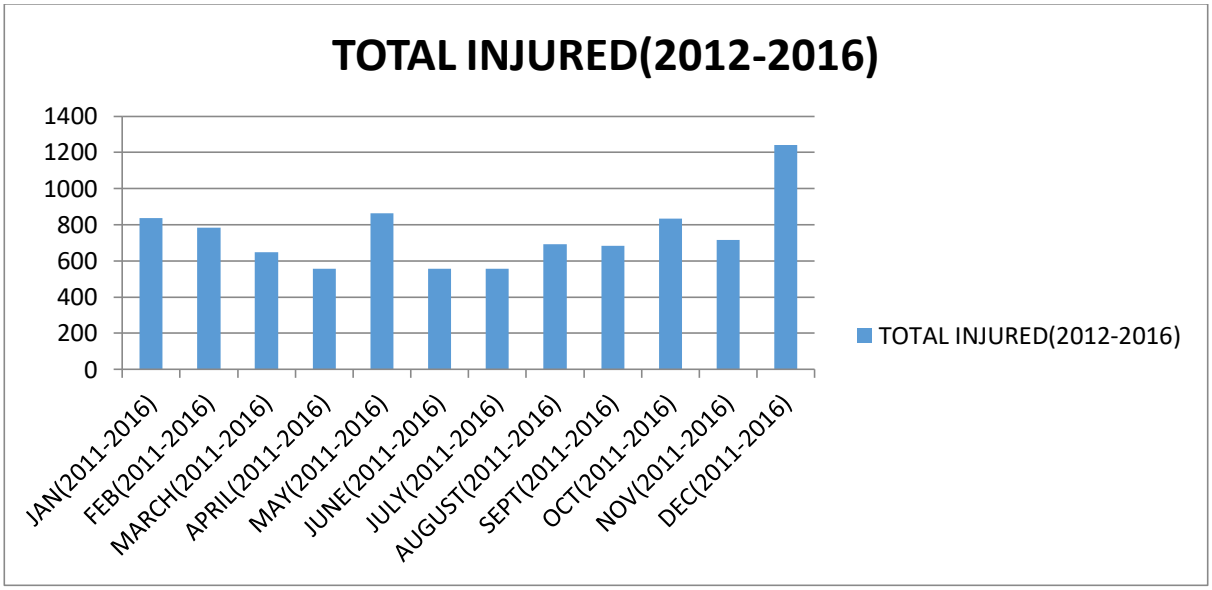


Fig 16.Grph of total people injured from 2012-2016

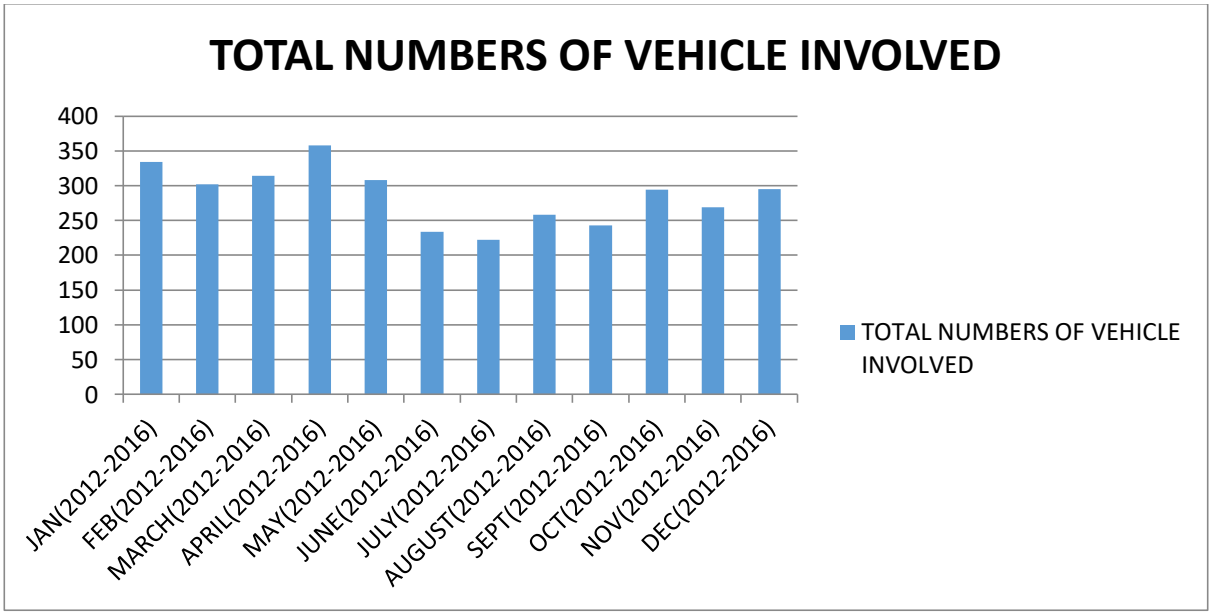


Fig 17.Graph of total vehicle involved in the accident from 2012-2016

Analysis accidents based on type of vehicle

The query to the database is performed using type of vehicle involved in accidents. The vehicles have been classified into four categories

- Bus: i.e. hummer bus, litace bus costar bus etc
- Lorries: i.e. thriller, tipper
- Starlet: i.e. Toyota starlet, golf,
- Others: i.e. jeep, Camry, Mercedes bens etc

It can be clearly seen that bus type of vehicles are more involved in accidents as compared to other Vehicles followed by Lorries. This is due to the fact that most drivers of such vehicles are inexperience and the nature of the road is bad and lake of enough traffic signs on the road.

Table 18. Showing the types of vehicle involved in the accident from 2012-2016

Types of vehicle	2012	2013	2014	2015	2016	Total
Bus	238	160	318	291	317	1324
Lorries	180	142	283	260	288	1153
Starlet	150	60	231	143	131	715
others	52	38	30	16	32	168
Total	620	400	862	710	768	3360

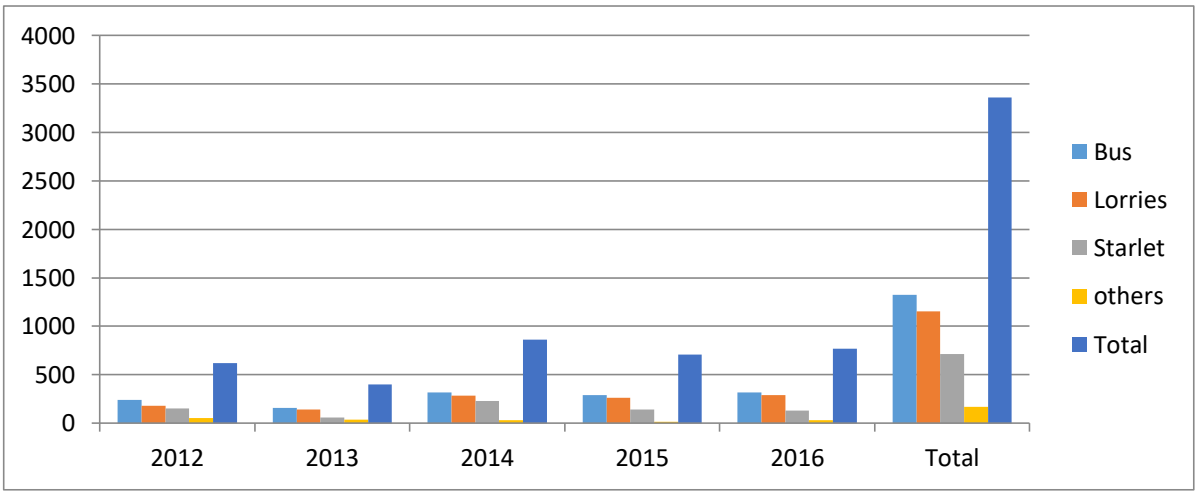


Fig 18.types of vehicles involved in accident from 2012-2016

CONCLUSION AND RECOMMENDATION

Guarding against the causes of road traffic accident is a collective affair as it affects everyone directly or indirectly. Haven identified some of the remote and immediate causes of road traffic accidents in Nigeria, here are some of the suggested preventive measures if well adopted and practiced, will go a long way towards reducing and curtailing road traffic accidents in Nigeria

To mitigate these challenges leading to road traffic accidents in Nigeria, roads must be widened and well maintained with traffic free zones created; inter-sections and road signals must be improved upon; there must be freeway bottlenecks removal initiatives; there must also be special event management strategies in place; while traffic signals, lightings and signage must be improved; parking policy, park and ride facilities and end of year congestion management strategies must be developed and put in place and traffic rules and regulations must be observed.

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