STATISTICAL ANALYSIS OF ROAD CRASHES IN NIGERIA

[A CASE STUDY OF LAFIA MAKURDI HIGHWAY]

BY

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DECLARATION

I hereby declare that this project has been written by me and it is a report of my research work. It has not been presented in any previous application for the award of postgraduate diploma. All quotations are indicated and sources of information specifically acknowledge by means of references.

CERTIFICATION

The project "Time series analysis of road crashes Lifia – Markudi highway, meets the regulations governing the award of Post Graduate Diploma in Statistics, of the School Postgraduate Studies. Nasarawa State University, Keffi. And is approved of its contribution to knowledge.

_____ _____

Name supervisor Date

_____ _____

Name Head of Department Date

_____ _____

Name Internal Examiner Date

_____ _____

Name External Examiner Date

_____ _____

Name Date

Dean, School of postgraduate Studies

DEDICATION

This project is dedicated to Almighty God, my beloved parent Mr and Mrs Suleiman, friends and well wishers.

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My top most gratitude goes to Almighty “Allah” the creator of the universe and master of the day of reckoning for his guidance and protection through my academic struggles in this great institution. My profound gratitude is hereby reserved for my project supervisor Mr Nweze a man of unbeatable character for taking his time and energy to read through this work, make necessary corrections, and advising me despite the numerous schedules and academic commitments he is saddle with.

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ABSTRACT

This project examines the reported cases of road crashes in Nigeria using Lafia – Makurdi road as a case study for the period of 2002 to 2016. The method used in the data collection was secondary method. Time series and t- test were used to analyze the data. The result of the analysis showed that there is decrease in reported cases of cars crashes and increase in reported cases of buses clashes. From the t- test, it shows that there is significant difference between the reported cases of cars and buses that have crashes. It is therefore , recommended that; the Government should extend the road safety campaigns to every nook and cranny, as this will enlighten our people more on the risk of not maintaining discipline on the road when driving, the construction of Lafia - Markudi double lane should be done as a matter of urgency in other to reduce the rate of road crashes in that area, and visible traffic sign code should be placed in strategic area to help instruct road users.

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LIST OF ABBREVIATION

VIO	Vehicle Inspection Officer
FRSC	Federal Road Safety Commission
NPF	Nigeria Police Force
RTA	Road and Traffic Authority
NSW	New South Wales
LSM	Least Square Method
US	United State

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The ordinary use of the term ‘crashes’’ means an unforeseen and often disastrous event, occurrence usually producing unexpected and unpleasant consequence. It happens all over the world sometimes results into death, injury, damage of property etc. some crashes occur as a result of the carelessness of some drivers, many of them speed too much and some of them so much in hurry that they don’t mind over taking others vehicles even at a road bend when it will not be safe to do so. Another causer of the road crashes is the fact that many of the cars and Lorries that ply our roads is not road - Worthy, many of them has faulty brakes, or worn out tires. In this respect both the traffic police, vehicle inspection officer (V.I.O) and the road safety commission should co-operate to see that such vehicles are off road. A drunken driver on the road is a great danger both to himself and others. In additional undulating surfacing and culverts along the road should be widened and with more solid concrete, iron and steel materials.

It is no longer new that, road crashes claim several thousands of precious human lives annually over the world. It is also generally known that Nigerians ranks among the other countries with the highest rate of crashes in the world. The federal governments in their efforts to see that, the number of road crashes are minimized; introduced federal road safety commission was establish and charge with the major responsibilities of preventing trend of crashes on the high ways. At the initial stage, the activities of the commission were to look into monitoring the condition of the road and erecting road signs also involved in conducting researches into traffic density on major road and critical investigation of how driving vehicle license are being issued. The activities of the road safety commission have help to reduce the rate of country road crashes tremendously. There are various types of road crashes; it may be motorist , cyclist , pedestrian road crashes, which also claims lives.

As from early stage of the history of Nigeria, road crashes has immensely been a serious concern to both government and the citizens of this country.

Road crashes has been a disturbing phenomena that has constituted a menance, leading to the loss of lives and property annually. In accordance with federal road safety commission (FRSC) report (2012), thousands of people involved in road crashes are either killed or maimed and most of those involved are youths although, road crashes are undesirable chance events which can occur at any point in time with the consequences of interplay between three basic or major factor. These factors are:

i. human factor
ii. mechanical factor
iii. road factor

According to Bilikisu (1998) road accident earned this country, messy reputation recording the higher number of road crashes in African, even when such death be prevented or avoided. Abuja, Keffi and Lafia Makurdi road are the major road that links most of the state capital government of Nasarawa state to the state capital and federal capital territory, Abuja. This road can simply be described as every buses road, as it plied by articulated vehicles, buses, cars, lorries, long trailers, motor cycles, bicycles and pedestrians.

According to statistics record of the Federal Road Safety Commission (FRSC) Lafia, Nasarawa state, on the average of five articulated vehicles pass every minutes there by making high density pothole, dangerous bends and death record sign.

The high rate of road crashes along this route is surprise. Lastly, as regard to high way crashes on Nigeria highways, the federal government of Nigeria then established two offices, the traffic warden under Nigeria police force in 1975 and the federal road safety commission act through decree 45 of 1988 with responsibilities of preventing and minimizing road crashes on highway and clearing obstruction on any part of the road and educating drivers, motorist and other members of the general public on the proper use of highways, and to provide for other matters connected therewith.

Despite the fact that different agencies, group of people, organization, individuals have written different teachings about road crashes, but I will only in the case of this project work, Consider the following write up. Federal Road Safety Commission (FRSC) in Wasiu identified many factors that are responsible for road crashes in Nigeria cannot be measured by one single course. It may be that among factors which

can be attributed or identified or those that the driver have control or those factors include

1.2 Statement of the problem

Road crashes is an unexpected incident that is experienced on our roads by the users which lead to loss of lives or inflicts various kinds of injuries. The number of people involve in the road crashes has been of great concern to this country and the people within but how to find a lasting solution to this problem is always the question.

This study is therefore carried out to examine prevalence of road crashes along Lafia-Makurdi roads in Nassarawa state, Nigeria.

1.3 Aim and objectives of the study

The aim of this research is to analyze the time series of road crashes in Nigeria involving different types of vehicles reported on Lafia-Makurdi road in Nassarawa state. With the following specific objective;

i. to determine the trend movement

ii. to fit the trend line and make forecast

iii. to determine if there is any significance difference between the reported cases of cars and buses

1.4 Significance of the study

Road transport is an important service which enables people, firms and various activities to be carried out properly. Our social, economic, political and even lives can be entrenched or preserved in Nigeria only through effective and efficient transportation system devoid of road crashes

In the view of these, the research work will be important to;

i. Federal Government especially the Federal Road Safety Commission(FRSC)

ii. The Government at all level i.e, both the federal, state and local level

iii. It will also enlighten the drivers on the importance of road signs

iv. It will also serves as a guide to law makers on road safety and to anyone who may want to know more about road crashes in Nigeria

1.5 Scope of the study

The investigation is restricted to road crashes in Nassarawa State, this research work covers only road crashes which occurred between Lafia – Makurdi Road from 2002 to 2016.

1.6 Definition of relevant terms

The following definitions are cites in Marshal I .M(1989)

Crashes

These are unexpected sudden occurrence, unplanned events, which could lead to body injury, death or internal damage.

Fatal crashes

A road crashes is considered to be fatal if there is loss of life of some people.

Runs

Is a consecutive sense of similar items that are bonded by items of different types.

Serious crashes

A road crashes is considered serious if there is no loss of life but laying injury.

Causalities

Refers to people involve in the road crashes

Motorist

People in the vehicle as at the time of crashes

Unavoidable cause

They are cause which are beyond the fault tyre bust, brake failure e.t.c.

Time series

A Set of observation made at regular intervals

Pedestrians

People whom are working on the road

Distraction

Simple means to be taking way of one's attention from where it should be concentrated

CHAPTER TWO

2.1 LITERATURE REVIEW

A study of previous account of crashes in existing literature review of some associated factors. The essential factors involve in roads crashes include the person, the machine and the road. Most tragic crashes often involved all the three.

Often, the person are involved with one of the other persons are involved with one of the other two. A critical appraisal of factor is involved in road traffic crashes is necessary to identify and apportion responsibility for prevention.

In other to ensure safety on our roads, a lot of concerned citizens and scholars have embarked on researches to find out ways of arresting the situation.

Ogunsanya and Waziri (1979) attributed the causes of crashes to the environmental, road, vehicle and human factors. The environmental factors includes: weather factors such as rain and cloud. Natural hazards include landslide, volcanic eruptions and flooding.

Human activities that contribute and cause crashes include rubbish heaps on the road and abandoned, road construction with non warning signs. The authors concluded that human factors are the most important factors contributing to crashes. Other factors identify by the federal road safety commission include: distraction, i don't care attitude, drinking of alcohol, drugs, tiredness, poor vehicle condition, dangerous overtaking, Incompetence and over confidence and Conditions of road.

Distraction

Passengers by talking to drivers and showing them interesting things inside and outside the vehicle distract the driver and many contribute to crashes

I don’t care attitude

Passengers are responsible for crashes as well as drivers in many cases. Passengers board buses, taxes and private vehicles without even taking a look at the tyres to see if they are worn. Passengers other encourage speeding, reckless driving, overtaking at corners and other dangerous practice that may lead to dangerous crashes concentration. Drivers often talk, eat, gesticulate, wave to and stop at passing friends,

lighting of cigarette, smoke, change radio station, or changing cassette and making calls while driving. This lack of concentration is dangerous as it take only a split of second for disaster to strike. The vehicle is front may stop, a child may run into the road and anything could happen.

Drinking of alcohol

Can cause over confidence, poor judgment and recklessness. In many countries, it is a major cause of road crashes. This is the reason why special test are used to detect those who have been drinking. In Nigeria, this method of preventing crashes was briefly tried by the former Abuja Road Safety Corps and done in few state of the country. The lesson learnt and other countries are clear.

Drugs

Alcohols are drugs but there are many others as interfere with driving. Sometimes drugs that are prescribed by doctors have a sedative effect on drivers, coffee and cola nut are stimulant that sometimes increase the alertness of the person and are popular with long distance drivers. It must be an embayed that there is a saying; ‘’you can’t cheat nature’’. Such stimulants may work sometimes and then tiredness and sleeping comes suddenly often while driving, the result is another road disaster or crashes**.**

Tiredness

Many drivers travelled long distance without even stretching their legs and improving blood circulation to supply the brain adequately. This and the boredom of driving combined to make the drivers feel tired. It is frightening experience to be driving by who fall asleep while the vehicle is in motion. Sudden awaking may cause crashes, and leaving the driver asleep will certainly cause an crashes. Driving after heavy meal is hazardous as to the blood concentrate is the stomach to absorb the food. This deprives the brain of oxygen and can cause fatigues. Just imagine that some trailer drivers work on average of 10-12 hour per day, it is dangerous.

Poor vehicle condition

Drivers often do not check vehicle to ensure that they are in good condition for good road before setting out on a journey. Tyres and pressure are neglected also. Trafficator and vehicles in the middle of the road on highway to just change tyres or because of

engine trouble, which are responsible for crashes especially at right or around a sharp bend or close to the crest of a hill where the vehicle cannot be seen by another road users.

Some drivers broken vehicles do not give adequate warning sign to approaching vehicle and as such run into the vehicle. In some cases, hazardous obstacles placed on the road, to hinder normal flow of traffic are left behind when the vehicle moves on after repairs. This can endanger other traffic.

Dangerous over -taking

Dangerous over taking is responsible for about 48% of all the crashes in the country. Careless over taking and poor judgment can bring about crashes. The saying that ‘’it in doubt about your judgment, don‘t pays you better’’.

Incompetence

In Nigeria, most general attitude that could contribute to road crashes is the problem of incompetence that some people has the belief that whosoever has the money and purchased a vehicle without considering whether is capable to drive or not but the next to jump into the road and this could lead to a serious crashes.

Over confident

Some road users due to their belief that they know how to drive; therefore they can drive the way they like of which sometimes leads to crashes.

Condition of the road

The condition of the road is another factor responsible for road crashes in Nigeria. Many potholes characterize the road from lafia to markurdi are dangerous bend as we all know. Most crashes motorist swerves from one end of the road to another in a bid to avoid the potholes. In the process of avoiding potholes, drivers end up colliding with each another or loosing control and running into the bush. Also, the death road sign is also another problem along route responsible for crashes which would have been avoided if sufficient sign were placed.

According to Raymond (1977), noted that a lot of illiterates, who subsists on driving, had always secured their driving license with vigorous test.

Raymond further submitted that Nigeria is a country where license is sometimes issued by proxy. The applicant simply pays the required amount through the appropriate channel and in two or three weeks, this license is delivered to him even before he handles a steering wheel for the first time. According to Encyclopedia Britannica (1968) road crashes claimed over 100,000 lives almost every year and it is the forth of leading cause of death close the lead of heart disease, cancer and stroke. It was also stated that most young should be able to prevent themselves from death due to mobile crashes and win the battle of road crashes, survive till their expected age.

Achum (1998), observed how disorder has been the order of the day on road and expected the Federal Road Safety Commission (FRSC) to carry regular policy in order to check the activities of the dare well and greedy drivers. Achum further observed the need to subject would reduce the rate of motor to driving test before issuing them license as a way of curbing the menace of road crashes on our road.

Abah (2004) made it clear that to reduce the rate of motor crashes, the need to be educated on road signs and dangers in taking drugs. However, it also suggested that government should take a proper measure to deal with any driver found within any of the above offences and by improving the police and the road marshal's government has taken a great measure to put road safety commission and the police to minimize the crashes and also to take care of both the road and the users of the roads.

Ogunsanya and Waziri (1979) attributed the cause of crashes to environmental roads, vehicles and human factors, the environmental factor include weather.

Natural hazards and human activities, weather factors include elements such as rain and cloud . Natural hazards landslide, volcanic eruption and flooding, human activities that contribute with no warning sign to drivers. On the vehicle factor, the author stated that the usage of the vehicle beyond its useful lithe leads to crashes likewise sudden mechanical defects. The author also share that human factor crashes due drivers kill is rapid information make and consequent control of vehicle. His character, especially as related to his personality, department, drupe or alcohol make

hid nature for risk taking and advantages his education and driving capacity influence crashes.

Umaru, et al (2010) stressed that some driver's area engages in looking while driving. It seems that they have it as a policy to admire every object that skirt through their side mirror. No daughter of Eve must pass without attracting their attention, even though they are at the same time driving looking here and there while driving as a sign of indiscipline is a study of previous accounts of crashes in the existing literature revealed some associated factors. The essential factor involves road crashes include vehicle, the vehicle and the road not traffic crashes often involves all the three do in order to ensure safety on our road minimum standards must be set, so that patrol on the highways of making road users comply with rules and regulation designed to reduce unnecessary death on the road. To achieve this, lot of concerned citizens and scholars had embarked on researches to find out ways of arresting the situation.

Yarma (1998) wrote on the formation of the Federal Road Safety Commission (FRSC) established by decree 45 of 1998 and amended by decree 35 of 1992. The primary function of the commission was to recommend works and device designed to eliminate and prevent crashes on the highways. Yarma pointed out that before the establishment of the federal road safety commission (FRSC) 1998, the problem of road crashes had been so high and this has claimed so many lives and properties in Nigeria.

Ovuworie G.C. Oribere E.A .Asalor J. O. (1989) stated that crashes on our road is caused by six (6) related factors namely: vehicle, road drivers, weather system and circumstances related factor. Ovuworie stated that the solution to road crashes could be achieved if proper maintained.

Culture is introduce in all transport organizations, drivers property trained as necessary adequately by employers for fleet's vehicles in organization and argues the need for various government of the federation to pay sufficient maintenance of all roads to the federation.

Berube, A. et al(2007) note that, U.S department of transportation federal highway administration has a web page documenting a review of speed research as follows:

That the evidence shows the risk of having a crashes in increased for vehicle travelling, than the average speed and for those travelling above average speed.

That the risk of being injured increases exponentially with much faster, than the medina speed.

That the severity of the crashes depends on the vehicle speed change of impact .That most crashes related to speed too fast for the conductors .

Richard, 1999: the biggest killer on our roads the Road and Traffic Authority {RTA} of the Australian state of new south Wales (NSW), states that speeding a factor in about 40% of roads deaths on one specific piece of research from 1997 and state research that the risk of a crashes causing death or injury increases rapidly, even with small increase above an appropriate set speed. A road use capability is affected by the physical and mental ability asses conditions and respond quickly . Studies have established some common condition that impair this judgment, including: Poor eyesight and or requiring appropriate vehicle modifications before being allowed to drive .

Old age with some jurisdiction requiring driver retesting for reaction speed and eyesight after a certain again

Fatigue, excessive alcohol, with simple blood alcohol – alcohol limits enforced through drinking – driving laws (although, some level of impairment may occur below the legal limit).

A research suggests that the driver's attention is affected by distracting sounds such as conversation and operating a mobile phone within the car. Recent research conducted by British scientist suggests that music can also have an effect; classic music is considered to be calming, yet a condition of distraction (Bilkisu,1998).

2.2 Time series

Shittu and Yaya (2011), Time series is the record of observations measuring certain quantity of interest at regular or irregular interval of time. The observation may be recorded daily, weekly, quarterly, yearly or bi- annually. It is a realization or sample function from a certain stochastic process. Time series can also be defined as an ordered sequence of observation (a collection of observation made sequentially in time). Time series occur in many fields such as, Agriculture, Engineering, Business and Economics, Geography, Medical sciences, Meteorology and so on.

Component of time series:

There are factors that are assumed to be responsible for behavior or movement of time series namely; trend, seasonal, cyclical and irregular component.

i. Trend or secular movement: This is the long-term movement in a series in the same direction over a long period of time. It is usually characterize a continuous increase or decrease in the values on a variable over time. This movement is generally referred to as secular variation.

ii. Seasonal variation: This refers to the movement that repeats itself every year. The periodicity is regular and the duration is that year e.g. upsurge in the price of food during the Sallah and Christmas season are good examples.

iii. Cyclical variation: this is manifest inform of swing or oscillation about the trend line. it does not have regular periodicity and the duration is usually more than one year.

iv. Irregular Variation: This refer to erratic or sporadic movement of time series due to occurrence of random per chance event, which cannot foreseen, hence it can not be isolated directly. They are not deterministic.

2.3 Student t-Test

The student's t- distribution (Or Also t- Distribution) To probability and statistics, is a probability distribution that arises on the problem of estimating the mean of a normally distributed population when the sample size is small. It is the basis of the popular student's t – test for the Statistical Significance of the difference between two sample means and for confidence intervals for the difference between two population

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means. The student's t – Distribution is a special case of the generalized hyperbolic distribution. The derivation of three t -distribution was first published In 1908 By William Sealy Gusset, while he worked at a Guinness Brewery, Dublin. He was not allowed to publish under his own name. So the paper was written under the pseudonym student. The t- test and the associated theory became well known through the work of a Fisher who called the distribution "Student's Distribution".

CHAPTER THREE:

RESEARCH METHODOLOGY

3.1 Source of data

The data used in this project work is from federal Road Safety Commission (FRSC) State Headquarter office Lafia Nasarawa State.

3.2 Method of data collection

The method used for data collection is secondary method i.e this are data which already exist or gotten from other source and already collected used and stored materials.

3.3 Population of the study

The population under this project work is on different types of vehicles i.e Cars, Buses, Trucks and lorries that is involve on road crashes that occurred in Lafia – Makurdi Road Nasarawa/Benue State.

3.4 Sample of the study

The sample of this study is to cover road accident that occurred between cars and buses from 2002 to 2016 in Lafia - Makurdi roads.

3.5 Method of data analysis

The methods of data analysis used in this research work are as follows:

i. Time series (Least Square Method)
ii. T - test

(Least square method)

The straight line method

$Y_t = a + bx + e$

Where

Y = dependent variable

a = intercept

b = slope

X = independent variable

t = time

e = error term

Where

a = $\frac{\sum y}{n}$

b = $\frac{\sum ty}{\sum t^2}$

Student t- test

T= sp $\frac{X_1 - X_2}{\sqrt{\frac{1}{n_1} \quad \frac{1}{n_2}}}$

Where sp = $\sqrt{\frac{[n_2 - 1]\, s_1^2 + [n_2 - 1] s_2^2}{N_2 + n_2 - 2}}$

And

S_1 = $\sqrt{\frac{\sum [X_1 - X_2]^2}{n-1}}$

S_2 = $\sqrt{\frac{\sum [X_1 - X_2]^2}{n-2}}$

Hypothesis testing procedure using the t-test.

Hypothesis testing : A procedure , base on sample evidence and probability theory, used to determine whether the hypothesis is a reasonable statement and should not be rejected, or is unreasonable and should be rejected.

Hypothesis testing procedure

(1) State the null hypothesis and the alternate hypothesis

Null hypothesis :– statement about the value of a population parameter.

Alternative hypothesis :- statement that is accepted if evidence proves null hypothesis to be false.

(2) Select the appropriate test statistic and level of significance. When testing a hypothesis of a population. We use the Z-statistic or Z-test and the formula.

$$Z = \frac{P - P}{\sqrt{\frac{Pq}{n}}}$$

When test a hypothesis of a mean , we use the z – statistic or we use the t – statistic according to the following conditions. If the population standard deviation, δ, is known and either the is normal distributed or the sample size n >30, we use normal distribution (z - statistics).

When the population standard deviation, δ, is unknown and either the data is normally distributed or the sample size is greater than 30 (n >30), we use the t – distribution (t - statistics) ,

A tradition guideline for choosing the level of significance is a follows:

(a) The 0.10 level for political polling, (b) the 0.05 level for consumer research projects and (c) the 0.01 level for quality assurance work

3 State the decision rules.

The decision rules, state the conditions under which the null hypothesis will be accepted or rejected .The critical value for the test – statistics is determined by the level of significance. The critical value is the value that divides the non – reject region from the reject region.

4 Computer the appropriate test statistic and make the decision. When we use the Z-statistic. We use the formula

$$z = \frac{\bar{X} - \mu}{\frac{\delta}{\sqrt{n}}}$$

When we use the t – statistics. We use the formula

$$t = \frac{\bar{X} - \mu}{\frac{S}{\sqrt{n}}}$$

Compare the computed test statistic with critical value. If the computed value is within the rejection region(s), we reject the null hypothesis, otherwise , we do not reject the hypothesis.

5 Interpret the decision .

Based on the decision in number 4, we state a conclusion in the context of the original problem.

CHAPTER FOUR

4.1 PRESENTATION AND ANALYSIS OF DATA

Table 1: Number of vehicles that are involved in road crashes that occurs along Lafia Makurdi roads.

Years	Cars	Buses
2002	82	95
2003	84	105
2004	94	84
2005	30	76
2006	101	84
2007	82	76
2008	87	110
2009	80	105
2010	53	89
2011	111	76
2012	75	97
2013	96	83
2014	93	98
2015	56	112
2016	39	120

Sources: Federal Road Safety Commission state Head Quarter office Lafia Nasarawa state.

Table 3: Analysis of report cases of cars crashes.

Year	No. of car[y]	T	T^2	t_y
2002	82	-7	49	-574
2003	84	-6	36	-504
2004	99	-5	25	-495
2005	30	-4	16	-120
2006	101	-3	9	-303
2007	82	-2	4	-144
2008	87	-1	1	-87
2009	80	0	0	0
2010	53	1	1	53
2011	111	2	4	222
2012	75	3	9	225
2013	96	4	16	384
2014	93	5	25	465
2015	56	6	36	336
2016	39	7	49	273
Total	1168		280	-289

To fit trend line for cars

N= 15

$y_t = a + bt$

Where

$A = \frac{\Sigma y}{n}$

$B = \frac{\Sigma ty}{\Sigma t_2}$

$A = \frac{1168}{15} = 86.1 \cong 86.1$

B = $\frac{289}{280}$ = -1.0321428 ≅ -1.032

Therefore the trend line is y_t =86.1-1.032t

4.2 Forecast for car crashes for period of five [5]

Years from 2016 to 2024

Estimating for 2016 [9]

y_t= 86.1-1.032t

But t =9

= 86.1-1-032×9

= 86.1-9.288

y_t= 68.579=69

Therefore the expected cars crashes by the year 2016 will be 69

Estimating for 2018 [11]

y_t= 86.1-1.032t

But t = 11

= 86.1-1.032×11

= 86.1-11.352

y_t= 66.51567=67

Therefore the expected cars crashes by the year 2018 will be 67

Estimating for 2020[13]

y_t= 86.1-1.032t

But t = 13

= 86.1-1.032×13

= 86.1-13.416

y_t= 64.451= 65

Therefore the expected car crashes by the year 2020 will be 65

Estimating for 2022[15]

y_t= 86.1-1.032t

But t =15

= 86.1- 1.032×15

= 86.1-15.4

y_t= 62.387=62

Therefore the expected car crashes by 2022 will be 62

Estimating for 2024[17]

y_t= 86.1—1.032

But t =17

= 86.1-17.544

y_t= 60.323=60

Therefore the e expected car crashes by the year 2024 will be 60

Fitted trend equation

y_t 86.1-1.032t.

Summary of forecasting for car crashes rate from

2016—2024

Period	Forecast
2016	69
2018	67
2020	64
2022	62
2024	60

From the analysis the trend has shown that there is decrease road crashes

Years	Cars	Yt = 86.1-1.032t
2002	82	85.091
2003	84	84.059
2004	99	83.027
2005	30	81.995
2006	101	80.963
2007	83	79.931
2008	87	78.899
2009	80	86.1
2010	53	76.835
2011	111	75.803
2012	75	74.771
2013	96	73.739
2014	93	72.707
2015	56	71.675
2016	39	70.643

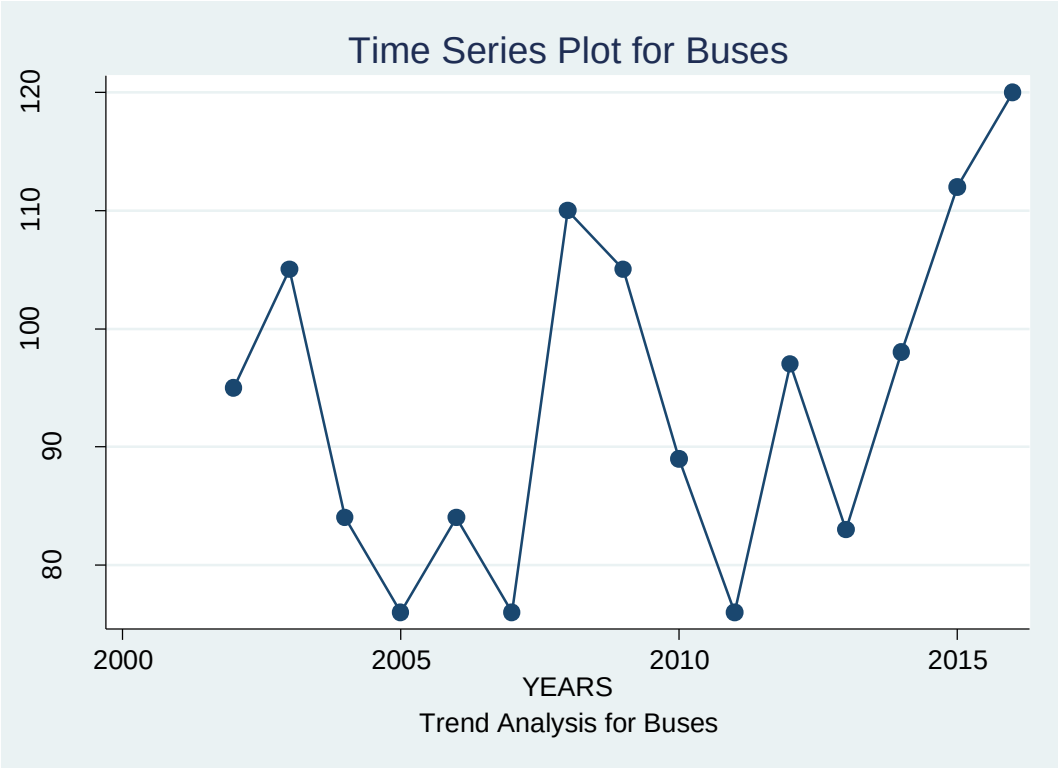

Time Series Plot for Buses
120
110
100
90
80
2000
2005
2010
2015
YEARS
Trend Analysis for Buses

Table.4 :Reported cases of buses crashes

Years	**Number of buses**
2002	95
2003	105
2004	84
2005	76
2006	84
2007	86
2008	110
2009	105
2010	89
2011	76
2012	97
2013	83
2014	98
2015	112
2016	120
Total	1430

Table.5 Analysis of cases of buses crashes

Year	**Number of buses [y]**	**t**	**t_2**	**ty**
2002	95	-7	49	-665
2003	105	-6	36	-630
2004	84	-5	25	-420
2005	76	-4	16	-304
2006	84	-3	9	-252
2007	96	-2	4	-192
2008	110	-1	1	-110
2009	105	0	0	0
2010	89	1	1	89
2011	76	2	4	152
2012	97	3	9	291
2013	83	4	16	332
2014	98	5	25	490
2015	112	6	36	672
2016	120	7	49	840
TOTAL	1430		280	293

To Fit Trend Line For Buses

N=15

yt = a + bt

Where

a = $\frac{\sum y}{n}$

b = $\frac{\sum ty}{\sum t2}$

a = $\frac{1430}{15}$ = 86.9619

b = $\frac{293}{280}$ = 1.046421 = 1.046

$y_t = a + bt$

Therefore the trend line is yt = 86.9619 + 1.046t

Forecast for bus crashes for period five (5) years from 2016 to 2024

Estimating for 2016 (a)

$y_t = 86.9619 + 1.046t$

But t = a

=86.9619 + 1.046 × 9

= 86.9619 + 9.414

$y_t = 104.747 = 105$

Therefore the expected busses crashes by the year 2016 will be 105

Estimating for 2018 (11)

$Y_t = 86.9619 + 1046t$

But t = 11

= 86.619 + 1.046 × 11

= 86.619 + 11.506

= 106.839 =107

Therefore the expected buses crashes by the year 2018 will be 107

Estimating for 2020 (13)

$y_t = 86.9619 + 1.046t$

But t = 13

= 86.9619 + 1.046×13

= 86.9619 +13.598

y_t = 108.931= 109

Therefore the expected buses crashes by the year 2020 will be 109

Estimating for 2022 (15)

y_t = 86.9619 + 1.046t

But t = 15

= 86.9619+1.046 ×15

= 86.9619 + 15.69

y_t = 111.023= 111

Therefore the expected buses crashes by the year 2022 will be 111

Estimating for 2024 (17)

y_t = 86.9619+1.046t

But t = 17

= 86.9619 +1.046×17

=86.9619+17.782

y_t=113.115=113

Therefore the expected buses crashes for year 2024 will be 113

Fitted trend equation

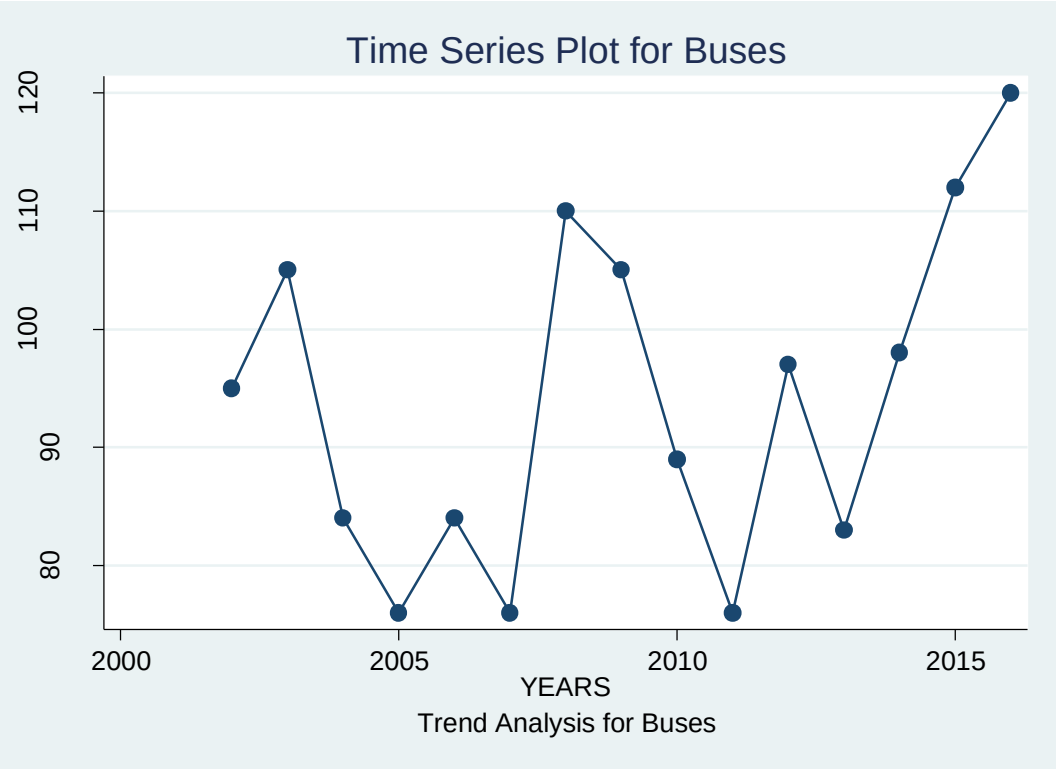
y_t = 86.9619 + 1.046t

Summary of forecasting number of bus crashes from 2016-2024

Period	Forecast
2016	105
2018	107
2020	109
2022	111
2024	113

From the analysis above, the trend has shown that there is an increase in road crashes

Year	Busses	YT= 86.9619 +1.046t
2002	95	88.011
2003	105	89.057
2004	84	90.103
2005	76	91.149
2006	84	92. 195
2007	96	93.241
2008	110	94.287
2009	105	86.9619
2010	89	96.379
2011	76	97.425
2012	97	98.471
2013	83	99.517
2014	98	100.563
2015	112	101.609
2016	120	102.655


Time Series Plot for Buses
120
110
100
90
80
2000
2005
2010
2015
YEARS
Trend Analysis for Buses

4.3 Table 6 :t-distribution

Year	**Cars (x_1)**	**Busses(x_2)**
2002	82	95
2003	84	105
2004	99	84
2005	30	76
2006	101	84
2007	82	96
2008	87	110
2009	80	105
2010	53	89
2011	111	76
2012	75	97
2013	96	83
2014	93	98
2015	56	112
2016	39	120
Total	**1168**	**1430**

Consider the hypothesis

H_O: there is no significant difference between the reported cases of the car and buses crashes

H_1 : there is significance difference between the reported cases of car and buses crashes.

Test of statistics

$$t = \frac{\bar{X}1-\bar{X}2}{SP\sqrt{\frac{1}{n} \quad \frac{1}{2}}}$$

where sp = $\sqrt{\frac{(n1-1S1^2+(n2-1)S2^2}{N1+n_2-2}}$

and

$S_1 = \sqrt{\frac{\sum(x_1-\bar{X}_2)^2}{n-1}}$

$S_2 = \sqrt{\frac{\sum(x_2-\bar{X}_2)^2}{n-1}}$

$x_1 = \frac{1168}{15} = 77.8666 \cong 86.1$

$x_2 = \frac{1430}{15} = 86.9619$

And

$S_1 = \sqrt{\frac{\sum(x_1-x_2)^2}{n-1}}$

$S_1 = \sqrt{\frac{(82-77.867)^2+(84-77.867)^2+(39-77.867)^2}{15-1}}$

$S_1 = \sqrt{\frac{7731.5+2513.84}{28}}$

$S_1 = \sqrt{\frac{7703.734}{14}}$

$S_1 = 550.267$

$S_1 = 23.4577$

$S_1 = 23.5$

$S_2 = \sqrt{\frac{\sum(x - x_2)^2}{n-1}}$

$_2 = \sqrt{\frac{(95) - 86.9619)^2 + (105-86.9619)^2 + (120-86.9619)^2}{15-1}}$

$S_2 = \sqrt{\frac{2495.334}{14}}$

$S_2 = \sqrt{178.238}$

$S_2 = 13.350558 = 13.4$

$Sp = \sqrt{\frac{(n_1 - _1)\, S_1 2 + (n^2 -) S_2 2}{n_1 + n_2 - 2}}$

$Sp = \sqrt{\frac{(15-1)23.5^2 + (15-1)13.4^2}{15+15-2}}$

$Sp = \sqrt{\frac{(14)\ 502.25 + (14)\ 179.56}{30-2}}$

$Sp = \sqrt{\frac{10245.34}{28}}$

$Sp = \sqrt{365.905}$

$Sp = 19.1286$

$T_{cal} = \frac{77.867}{\sqrt{0.0667 + 0.0667}}$

$T_{cal} = 19.128\ \frac{-17.466}{\sqrt{0.1334}}$

$t_{cal} = \frac{-17.466}{19.1286\ x\ 0.3652}$

$t_{cal} = \frac{-17.466}{6.9858} = 2.5002$

Therefore $t_{cal} = -2.5002$

Tα, $n_1 + n_2 - 2$

$t_{tab} = (n_1+n_2-2)$d.f

= 15+15-2=28

T0.05,28= -2.048

Decision Rule

Reject H_o if $t_{cal} > t_{tab}$ do not reject, otherwise accept.

Conclusion

Since/t_{cal} / = 2.5002 > -2.048, reject H_o and conclude that there is significant difference between the reported cases of cars and buses crashes.

CHAPTER FIVE

FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1 Summary of findings

From the plot in both car and buses reported of crashes, the trend for cars indicates down wards movement while the trend for buses crashes showed upward movement.

For the time series analysis the trend movement (yt= 86.1-1.032t) and (yt= 86.9619+1.046t) for cars and buses respectively and estimating for cars and buses for the year 2016, 2018, 2020, 2022 and 2024 the expected reported cases of crashes will be 68, 66, 64, 62, 60, and 104, 106, 108, 11 and 113 from cars and buses respectively.

And from t- distribution analysis, it shows that is a significance difference between the reported cases of cars and buses crashes.

5.2 Recommendations

Based on the findings the following are recommended

i. The government should as matter of urgency extend the federal road safety commission to every nook and cranny, for this will enlightened our people more on the risk of not maintaining discipline on the road while driving.

ii. The construction of Lafia Markurdi road double lane should be done as matter of urgency in order to reduce the rate of road crashes in that area.

iii. Visible traffic sign code should be place in strategic areas to help instruct road users.

iv. The government and law enforcement agencies should make sure that only road worthy vehicles is allowed to ply our highway.

v. The federal road safety commission should be ensure that duly tested and fit driven should be issued the driving license.

vi. Medical examination should be done on brain, eye and fitness before giving license to drive.

vii. The modern age people with eye problem should not be allowed to drive.

viii. There should be an extensive training and retraining of drivers on how and when to use road signs.

ix. Good road network should rate first among the government to priorities and be properly maintained.

5.3 Conclusion

i. From the analysis above for the cars, the trend has shown that there is decrease in road crashes

ii. From the analysis above for buses, the trend has shown that there is an increase in road crashes.

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