Trend Analysis of Road Traffic Accidents in Port Harcourt, Rivers State, Nigeria

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Abstract:- This study is focused on examining the trendand pattern of road traffic accidents in Port Harcourt, Rivers State, Nigeria over time (from 2005 to 2019). Using the time series analysis, the study revealed the direction or pattern of road traffic accidents in Port Harcourt. Both primary and secondary sources of data on road traffic crashes were utilized. Periodic documentary reports from the Federal Road Safety Office, Port Harcourt formed greater percentage of the secondary sources of data. The trend shows that accidents were not uniform over the years. The result of the prediction of accident between 2020 and 2024 shows a downward slope; meaning a downward reduction in accidents from 2020 to 2024. Based on the findings of the study, it was suggested that stringent measures and enforcement be put in place by traffic regulation agencies. Also, adequate enlightenment programmes should be mounted regularly by FRSC for effective sensitization of motorists.

Keywords:- Trend Analysis, Time Series, Road Traffic, Accidents, Casualties, Motorists.

I. INTRODUCTION

The importance of transportation to human wellbeing and economic development cannot be over emphasized. The invention of automobile has increased the mobility of man all over the world (World Bank, 2013). In Nigeria and other countries, the industry is generally regarded as an engine room of development because of the crucial role it plays in linking all segments of the economy (FRSC, 2012). Despite the importance and contributions of road transportation to economic development and social well-being of man and society, its unregulated and improper use has adverse effects on man, the environment and the society it serves. The adverse impact of automobile traffic on human health can be categorised into three namely; air pollution, noise pollution and traffic accidents. An estimated 1.3 million people are killed through road accident annually around the world and as many as 50 million suffer from injuries (Murtala, Raji and Udokang, 2015). In some developing countries of the world like Nigeria, traffic crashes constitute the greatest problem that requires urgent attention. The issue has not received the attention it deserves likely due to the nation's state of under-development (Atubi, 2012).

The first African Congress on road safety in Nairobi 1989, placed Nigeria far ahead of other nations in African in terms of mortality rate on the highways. In the same vein, Kenya was rated very high in terms of her fatality rate worldwide, due to automobile ownership and related crashes with the average of 7 casualties in 35 daily accidents or about 3,000 persons killed in about 13,000 yearly traffic accidents (Finch, Komptiner, Lockwood, and Maycock, 1999). This culminates in almost 68 people killed in every 10 thousand vehicles, a proportion or number which is up to 40 times more than what is obtained in most of the 'industrialized nations of the world.

However, the situation in Nigeria is worse than many nations of the world considering the number of road crashes which is obvious despite the good network of roads (Atubi, 2010). The factremains that crash proportion in Nigeria is ranked ahead of other countries in Africa. The Federal Road Safety Commission Report (2008) shows that from the period of 1970 to 2005, Nigeria witnessed 726,383 road traffic crashes, killing up to 208,655 people with injuries amounting to 596,425. In the same vein, Lagos State alone witnessed up to 39,141 road traffic crashes in the period 2011 to 2015 killing 10,132 people while those injured were 18,972 (Atubi, 2017). He added that every progressive year within the study period witnessed an increment in accidents, deaths, and injuries. This therefore shows that the Nigeria accidents' pattern and occurrences tend to show that better roads result in more casualties and more proportion in the intensity and number of deaths due to driver's non-compliance to road traffic rules (Onakomaiya, 2000; Gbadamosi, 2004; Filani and Gbadamosi, 2007).

The trend of road accidents situation in Port Harcourt urban is almost similar to other parts of the country. Report of the Federal Office of Statistics (2016), shows that Port Harcourt has a steady accident rate since its creation in 1990. In the year 1996, 60 deaths were recorded, in 1997, 29 deaths, in 1998 it rose to 135 deaths and in 2013, 2014, and 2015 the figures were 190, 254 and 242 respectively (Arosanyin, 2017). Although many works incorporated different aspects of road traffic accidents in their studies at different times and places, studies typically examining the trend of road traffic accidents in Port Harcourt is scanty. It is on this basis, that this study seeks to analyse the trend of road traffic accidents in Nigeria with particular reference to Port Harcourt city, Rivers State, using time series analysis.

II. THE CONCEPT OF TREND ANALYSIS

The concept of trend analysis as a sub-set of time series analytical techniqueis the aspect of technical analysis that tries to predict the future behaviour events using past data. It is also defined statistically as a technique for extracting an underlying pattern of behaviour in a time-series, which would otherwise be partly or nearly completely hidden. Trend is the general pattern of fluctuation of data over time. Time series is a set of observations taken at specific times, usually at equal intervals such as daily, weekly, monthly or yearly (Ndiyo, 2005). As a form of statistical analysis, it enables one to

predict or determine the behaviour of past data. The relevance of trend analysis is vital to every competent technical analysis. This is based on the firm belief of the philosophical construct of technical analysis, using time series.

III. COMPONENTS OF TIME SERIES

Statistical analysis involving time series may be classified into four main types, often called the components of time series. They are; the trend, cyclic variations, seasonal variations and irregular (random) variations. Trend analysis is however adopted for this study. In the analysis, the 'least square method' was used as it is the most widely used method of trend estimation; and is based on the method of regression analysis. It involves finding an equation for the trend. As a regression analysis, the points (values) are plotted on a graph and fit a trend line to the set of data using the equation obtained below. The equation is used to get the trend values and the trend line. The general equation is as follows:

$$y = a + bx + e$$

Where y = estimated value of the dependent variable
a = y intercept (where the regression line touches y axis)

b = regression coefficient or slope

x = independent variable
e = residual error

IV. MATERIALS AND METHODS

Port Harcourt city, the study area is the administrative capital of Rivers State of Nigeria. The city lies along the Bonny River and is located in the Niger Delta. Port Harcourt is located between latitudes 6° 58'N and 7^0 6'N of the Equator, and between longitude 4° 40'E and 4° 55'E of the Greenwich Meridian. It falls almost entirely within the low-land swamp forest ecological zone and is flanked in the east, west, north and southern limits by mangrove swamp forest (Akpogomeh, 2010). Port Harcourt grew from an area of 15.54km^2 in 1914, to an uncontrolled area of 360km^2 in the 1980s (Ayotamuno and Gobo, 2004). As the capital of Rivers State, the city has become an important administrative centre with regular road, water and transport services to other parts of Nigeria. Port Harcourt has a population of 1,865,000 people and a population density of 15.54 person/square kilometres (NPC, 2006). This figure was projected to 2019 using 3% growth rate, resulting to 2,037,936. The city is highly heterogeneous and it inhabits people from different ethnic groups all speaking different languages. The main socio-economic activities of the people of Port Harcourt city include fishing, industrial and commercial activities.

The study relied mainly on secondary data. The data on accident cases were mainly from Federal Office of Statistics and Federal Road Safety Commission, Port Harcourt.

V. DATA ANALYSIS AND RESULTS

A. Road Traffic Accidents in Port Harcourt

Table 1 shows the yearly number of road traffic accidents in Port Harcourt from 2005 to 2019 as recorded by Federal Road Safety Commission. From the table, a total of 1,190 accident cases were recorded in the study area within the period under study. During this period, 2006 and 2010 had the highest number of accidents with 123 cases constituting 10.3percent. This was followed by the year 2005 with 122 cases representing 10.2 percent. Furthermore, the year 2007, 2009 and 2008 recorded 115, 109 and 104 accident cases with percentages of 9.3, 9.2 and 8.7 respectively. The number of road traffic accidents in the years 2006and 2010 were high because of the high rate of motorcycles ownership in Port Harcourt.

However, the table shows a decline in road traffic accidents from 2007 to 2008; with marginal increase in 2009 of 109 cases. After 2010 the figure dropped to 48 and rose again in 2012 with 61 accident cases. Thereafter, there was a rise and fall in the figures. This could be attributed to the ban on motorcycle mode of public transportation in the city. The year 2013 had the lowest accident cases of 31 constituting 2.6 percent. This could be due to neglect in recording or reporting of accident cases in the state (FRSC 2013). Generally, the trend could be as a result of rapid rate of motorization and urbanization in the state capital. The table also showvariations in the nature of accidents; whether fatal or minor within the same period, including the number of vehicles involved and the major causes of accidents.

S/N	Year	Number of Accidents
1	2005	122
2	2006	123
3	2007	115
4	2008	104
5	2009	109
6	2010	123
7	2011	48
8	2012	61
9	2013	31
10	2014	69
11	2015	48
12	2016	56
13	2017	51
14	2018	67
15	2019	63
Total		1,190

Table 1: Yearly Number of Road Traffic Accidents in Port Harcourt (2005 – 2019)

Source: Federal Road Safety Commission, Port Harcourt, Rivers State (2020)

B. Time Series Analysis

This analysis employed the Least Square Method. Data for the analysis were gotten from Table 1. The results are presented below:

Year	Number of Traffic Accidents (y)	x	x^2	xy
2005	122	0	0	0
2006	123	1	1	123
2007	115	2	4	230
2008	104	3	9	312
2009	109	4	16	436
2010	123	5	25	615
2011	48	6	36	288
2012	61	7	49	427
2013	31	8	64	248
2014	69	9	81	621
2015	48	10	100	480
2016	56	11	121	616
2017	51	12	144	612
2018	67	13	169	871
2019	63	14	196	882
Total	$\sum y = 1190$	$\sum x = 105$	$\sum x^2 = 1015$	$\sum xy = 6761$

Table 2: Time Series Analysis Table

Source: Personal Computation, 2020.

Using y = a + bx + e (as above)

$$a = \frac{(\sum y)(\sum x^2) - (\sum x)(\sum xy)}{N(\sum x^2) - (\sum x)^2} \qquad b = \frac{N(\sum xy) - (\sum x)(\sum y)}{N(\sum x^2) - (\sum x)^2}$$

Therefore: $a = \frac{(1190)(1015) - (105)(6761)}{15(1015) - (11025)} = \frac{1207850 - 709905}{15225 - 11025} = \frac{1207850 - 709905}{15225 - 11025}$

$$= \frac{497945}{4200} = 118.56; \quad a = 118.56$$

$b = \frac{15(6761) - (105)(1190)}{15(1015) - (11025)} = \frac{15(6761) - (105)(1190)}{15(1015) - (11025)} = \frac{101415 - 124950}{15225 - 11025}$

$$= \frac{-23535}{4200} = -5.60; \, b = -5.60$$

Hence, the <u>trend equation</u> is:

$$y = 118.56 + (-5.60)x + e$$

where x = 0; y = 118.56

      x = 1; y = 118.56-5.60(1) = 112.96
      x = 2; y = 118.56-5.60(2) = 107.36
      x = 3; y = 118.56-5.60(3) = 101.76
      x = 4; y = 118.56-5.60(4) = 96.56
      x = 5; y = 118.56-5.60(5) = 90.56
      x = 6; y = 118.56-5.60(6) = 84.96
      x = 7; y = 118.56-5.60(7) = 79.36
      x = 8; y = 118.56-5.60(8) = 73.76
      x = 9; y = 118.56-5.60(9) = 68.16
      x = 10; y = 118.56-5.60(10) = 62.56
      x = 11; y = 118.56-5.60(11) = 56.96
      x = 12; y = 118.56-5.60(12) = 51.36
      x = 13; y = 118.56-5.60(13) = 45.76
      x = 14; y = 118.56-5.60(14) = 40.16
      x = 15; y = 118.56-5.60(15) = 34.56

- **Decision:** Using the trend equation y = 118.56 + (-5.60)x + e, it was possible to evaluate the trend in the number of traffic accidents from the period of 2005 to 2019 as shown in table 3. The trend equation can also be used to determine or predict the trend of the number of traffic crashes in subsequent years to come.

Year	Trend Value
2005	112.96
2006	107.36
2007	101.76
2008	96.56
2009	90.56
2010	84.96
2011	79.36
2012	73.76
2013	68.16
2014	62.56
2015	56.96
2016	51.36
2017	45.76
2018	40.16
2019	34.56

Table 3: Traffic Accident Trend Analysis (2005 – 2019)

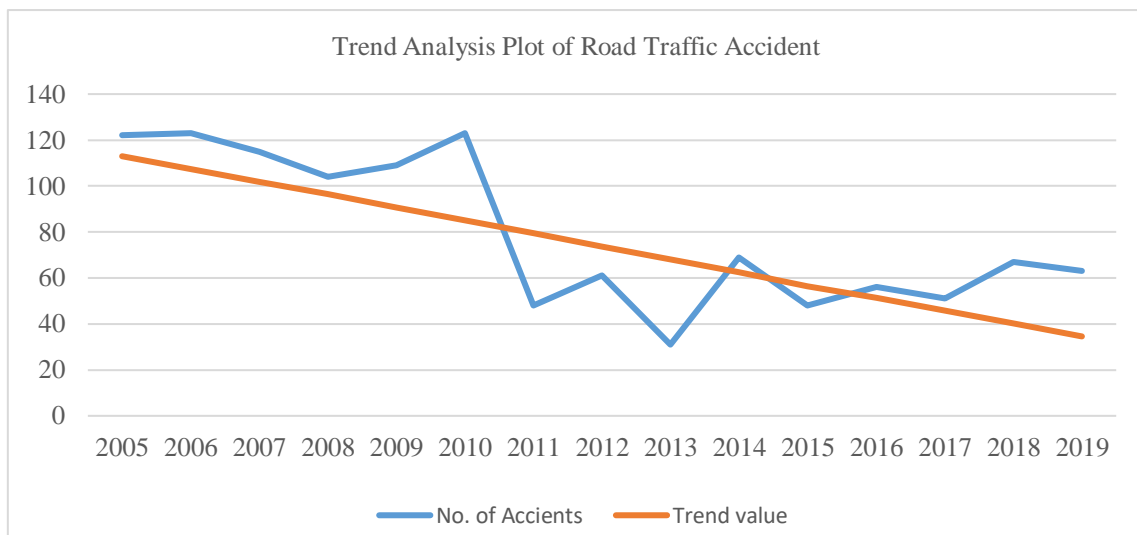**Source***: Statistical Calculations, 2020*

Fig. 1: Trend Analysis Plot of Road Traffic Accident

C. Traffic Accident Trend Value Prediction (2020-2024)

Accident trend was predicted for a period of 5 years (2020 -2024) using the existing formula and data in table 3, the predicted accident rate was calculated as shown below:

For the year 2020, x = 16; y = 28.96
For the year 2021, x = 17; y = 23.36
For the year 2022, x = 18; y = 17.76
For the year 2023, x = 19; y = 12.16
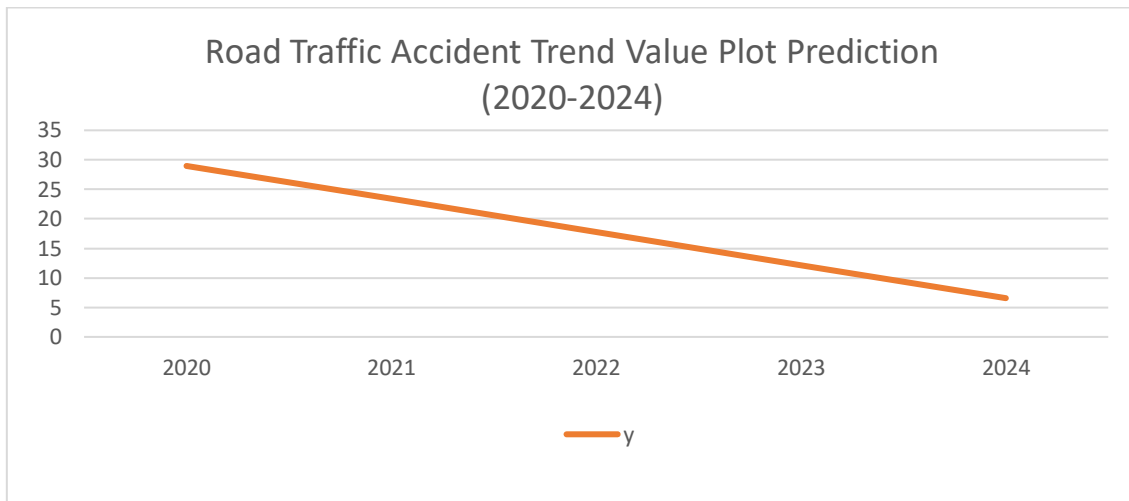For the year 2024, x = 20; y = 6.56

Fig. 2: Road Traffic Accident Trend Value Plot Prediction (2020-2024)

From the above information as substantiated by the statistical calculation, it is clear that accident trend is likely to be reducing over time. This reduction could be due to the fact that measures to arrest uncertainties that may have the potentials of increasing accident shall have been implemented in the study area.

VI. RECOMMENDATIONS

- Road traffic accidents cannot be wished away completely, particularly in the study area.For the result of the predicted trend to be maintained there would be need for stringent measures and proper enforcement by traffic control agencies in the city.
- Traffic accidents are caused by various factors including bad roads therefore, the Government of Rivers State should ensure regular rehabilitation, reconstruction and maintenance of roads in the city.
- More staff concerned with road traffic management should be recruited. This increase in man power will encourage effective traffic control to reduce road traffic crashes in the study area.
- Above all, effective sensitization of motorists by the Federal Road Safety Commission (FRSC), Port Harcourt Unit should be carried out regularly.

VII. CONCLUSION

The main objective of this study was to examine the trend and pattern of road traffic accidents in Port Harcourt, Rivers State. By this, it was observed that the trend and pattern of road accident in the area vary across tAhe years. However, the predicted trend values for the next 5 years (2020 – 2024) was carried out. The result shows that traffic accidents will reduce in the study within the period. The reduction may be as a result of some likely measures that will be implemented in the study area to reduce auto-crash.

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