TRAFFIC VOLUME STUDY OF A MAJOR URBAN INTERSECTION, A CASE STUDY OF UBTH UGBOWO LAGOS ROAD

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CERTIFICATION

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DEDICATION

This work is dedicated to God Almighty, who has given me the grace and opportunity to be alive and set to round off my undergraduate study in this great University, may His name be praised and glorified forever.

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ABSTRACT

The essence of traffic volume count in any society cannot be overemphasized. The importance varies from city to city depending on its level of development and the projected level of safe and efficient traffic management it aims at attaining within a stipulated time. This study has reviewed and highlighted and discussed the causes, general effects and possible solutions to the regular traffic congestions on the University of Benin Teaching Hospitals Junction which has become a norm for decades.

The study employed simply method of manual traffic count in obtaining the data required for the study. A set of questionnaires with few relevant questions concerning the management of traffic on the junction was equally administered on the drivers who ply the junction within the period of the study. Tally system of bundle and strokes were used in the study for easy documentation of the volume of the traffic being counted.

The study has reviewed the major causes of traffic congestion on the junction to include inadequate parking space, low carrying capacity of the junction as compare to the expected traffic, poor traffic management, lack of basic traffic facilities and personnel, poor implementation of traffic rules and regulations and disobedience to traffic orders and wardens. It has also suggested some of the remedies to include construction of standard interchange structures such as overhead bridge and flyover on the junction, stiffer measures on the traffic offenders, implementation of traffic policies and periodic traffic study on the junction and installation of traffic facilities on the junction to ensure smoother flow of traffic considering the strategic importance of the intersection to the socio-economic well-being of the Benin-City, Edo State and Nigeria in general.

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CHAPTER ONE

INTRODUCTION

1.1 Background of Study

Traffic congestion is one of the major transport problems usually associated with urban and developing areas. Due to traffic congestions, road accidents easily occur due to poor traffic management usually associated with developing countries like Nigeria and some other African countries (Zadobrischi, 2020). It has been reported by several researchers that transportation is one of the major livewires that hold the economy of every nation. Road transportation is commonest mode of transportation in Nigeria owing to its availability and affordability (Amos, 2011). The issue of traffic congestion is a global problem which everyone detests, hence, it has been identified as a global concern especially in highly urbanized areas where there is constant influx of people and vehicles on daily basis without any feasible corresponding expansion of the road infrastructures or provision of any other artificial means of through which the effect of such influx can be managed very effectively (Zochowska, 2016). The term traffic congestion has been described by different researchers in different ways, however, the most widely accepted definition was the one given by the Joint Transportation Research Centre (JTRC), an agency under the Organization for Economic Corporation and Development (OEDC). The agency defined traffic congestion as a scenario in which the demand for road space exceeds its supply (Odifiri, 2017). The JTRC also defines it as a the impedance which vehicles exert on each other as a result of speed flow in relation to the conditions where the use of transportation system approaches its total capacity(Nwankwo, 2019). Some of the common causes of traffic congestions have been identified to include

i. the sudden or unauthorized encroachment of the roads by the pedestrians.

ii. rapid increase in the number of vehicles required for a given volume of people or goods.

iii. movement of heavy duty vehicles on roads not designed for them.

(Saravanan, 2014)

Previous researches have equally shown that traffic congestion leads to economic ills such as loss in economic productivity, accidents, high cost of transportation, stress, increase in the prices of goods and services, pollution, epidemics, delays and increase in the cost of vehicular maintenance (Nwankwo, 2019).

In order to eliminate road crashes and untimely death occurrences on the roads, it is necessary to find the proper solution for traffic management in Benin-city and the world in general (Marvae, 2015). In this study, the problems associated with traffic congestions in some parts of Benin-city are identified and carefully studied in order to find the causes, the economic effects and possible solutions to them.

The quality of life and economy of any society depends on the efficiency, comprehensiveness and the type of multimodal transport system available ensure quick movement of people and goods and services from one part of the society to another (Bhatt, 2018). It has been reported that transportation system involves the flow of people, ideas, materials, goods and services from one part to another which subsequently ensure the spatial distribution of resources within and outside the area. Transportation and exchange of goods and services are obligatory features of modern life because of its multi-dimensional functions, the inevitably interaction among people and the dynamic structure of the society (Marvae, 2015). A road can best be described as the livelihood of human civilization and social interaction (Sarkar, 2013). The

economic prosperity of any society therefore can best be enhanced by good road networks at different parts of the society. The settlement of human beings is naturally heterogeneous and dynamic which only a symbiotic system can satisfy likewise the market places which are greatly influenced by the distance, location and range of goods and services available for exchange. In 2015, Al-Dami observed that road network is one of the oldest infrastructures to occupy significant localities in modernization and sustainable development of any society in terms of daily activities from the ancient time to this modern days. As a result of such, high quality roads with good connections or linkages invariably improves the economic output of any society since it reduces trip time, cost and makes the planning region to be more economic attractive, reliable and more viable(Guhthire, 2012). It has also been observed that markets are fundamental in the socioeconomic, cultural, religious and the political life of people. This is because, despite the poor and low recognition of markets in the pre-independence era in Nigeria, the integration production and consumption platforms on which the economy thrives (Amott, 2006).

1.2 Statement of the Problem

Benin-City, the capital of Edo State is the fourth largest city in Nigeria after Ibadan, Port-Harcourt and Lagos cities (Nwankwo, 2019). It has an estimated human population of about two millions as at the end of the year 2021.The large population associated with the city has been attributed to the constant influx of people into the city in search of greener pastures. The population has been predicted to continuously increase exponential over time as the city continues to expand in size. As the number of people in the city increases, the number of vehicles in the city also increases. As a result of these increasing numbers of vehicles without any sustainable and reliable plans on effective transportation management system, traffic congestions in the city has also continuously increased and has now become a threat to the

economic growth and development of the city. To reduce this adverse effect of traffic congestion, there is a need for proper traffic study and analysis of data which are needed by the traffic engineers and other traffic managers for effective planning and improvement of the highways to ensure effective flow of traffic at all times within the city its environs.

1.3 Aim and Objectives

The aim of this study is to obtain reliable information on the nature and causes of traffic congestions at some strategic parts of Benin-city including the ever busy, UBTH Junction, Ugbowo and at the end of the study provide some necessary data which are essential for effective planning, designing, decision making, maintenance and management of the traffic conditions along the selected areas of study.

The specific objectives include:

i. to study the traffic flow pattern on weekdays and weekends for hourly and daily variations

ii. to carry out traffic volume counts on the selected road.

iii. to make recommendations which will improve the flow of traffic at the selected intersection.

iv. to evaluate the capacity of the road.

v. to determine the peak hour volume in PCU.

1.4 Scope of Study

This study is to be carried at the UBTH Junction, a very busy and one of the most traffic congested intersections in Benin-city.

The scope of the study includes

i. site reconnaissance survey and topographical mapping of the study area.

ii. selection of an adequate data collection method that is most suitable for the study area.

iii. carry out of volume counts from 6am to 6pm daily for a period of one week consistently without any compromise.

iv. collation and organization of data and computation of results from the observed data.

v. determination of the Peak Hour Volumes (PHV) for each day of the count.

vi. calculation of the Passenger Car Unit (PCU) from the available data.

vii. comparing the capacity obtained from the computation of results to the design capacity of the road in line with internationally recognized theories.

viii. Interpretation of the obtained results

ix. Recommendations on how to improve on the traffic management of the study area.

1.5 Justification of the Study

The situation of highway traffic across developing areas in Nigeria including Benn-city are disguising due to the traffic congestions that are experienced on daily on these highways which usually restrict or inhibit the smooth movement and sometimes leading to road crashes. Highways are the commonest means of transporting people, goods and services from one point to another, hence it is pertinent that the problems associated with it are solved or at least reduced to the barest minimum. In order to achieve some improvements on these highways,

traffic studies must be periodically usually conducted on them so as to ascertain the level of improvement needed to be done on the highway in order to ensure smooth flow.

This study is one of such essential ones since it aims at providing the literature and data in line with the current traffic volume experienced on daily basis on the study and this data are essential in the planning, designing, decision-making, maintenance and management of the traffic conditions of the study area. When these are achieved at the end of the study, it will help the traffic officers and indeed the general public to maintain more efficient, reliable, safer and healthier highways across the city and the study area in particular(Guhthire, 2012).

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of the Study

Traffic is not as a result of vehicular movement. It also consists of other users of the road such as the pedestrians, ridden animals and other form of conveyances which are either singly used in the combined form for the sole purpose of transporting people and goods from one point to another (Pokomy, 2017). A well planned and established highway traffic usually has well defined lanes, right-of- the way, and traffic intersections control systems so as to ensure effective flow of traffic. In a developed society, traffic is usually arranged in a systematic order under well-defined and established guidelines which provides that the traffic includes a given number of lanes, junctions, interchanges, intersections and traffic flow and monitoring signals (Adams, 2011). Traffic is general classified into three (3) types to include the heavy duty vehicles, other vehicles and the pedestrian traffics. The heavy duty vehicular traffic includes the trailers, trucks and the likes. The other vehicular traffic includes the motorcycles, the tricycles and the bicycles. The pedestrian in the other hands consists of other road users who trek along the designated parts of the highways (Mohammed, 2009). These types of traffic may share the same speed limits and easement or may simply be segregated. The complexity of the rules that govern traffic varies from country to country based and this depends on certain factor such as the available road capacity to the demand ratio, availability of technology, population and the availability of skilled traffic mangers (Saravanan, 2014). One of the advantages of a well-organized traffic system is that it provides a better organization of travel safety and efficiency which consequently results into a smooth flow of traffics. However, some factors can hinder this organization and result into unwarranted disruption on the highways. Some of these factors may include: road constructions, collisions

and the presence of debris of any form or kind on the highways. Also, in a typical freeway, disruption may still be witnessed for some period of time. This phenomenon is commonly referred to as traffic wave (Bhatt, 2018). When traffic organization is broken down, the consequence is usually gridlocks or traffic congestions. One of the best ways of avoiding the total breakdown involves the simulation of the organized system and this is often referred to as queuing theory. The stochiastic process application of some mathematical physics equations also help in ameliorating the menace of traffic breakdown and its consequences (Lammer, 2008).

2.2 Traffic

Traffic is usually made up of the different road users available on any given highway at any given time. Reliable information on the expected traffic volume on any given highway is vital as it helps in the selection of the design input materials of the road (Mario, 2013). This therefore usually suggests the need for new roads to be constructed or the existing one being improved on and adequately maintained as at when due. Traffic volume usually vary from season to season and time to time within a day on the same highway or intersection. The change over time is therefore carried out in relation to the variation in the economic activity being witnessed in the areas of influence of the road (Shake, 1976). The design of any highway structure must therefore be familiar with the extent of these fluctuations in volume so as to be able to assess the flow patterns and provide for them adequately. The directional distribution of the traffic and the manner in which its composition changes are also very essential parameters that must be considered during the design process. A good understanding of the relationship between these parameters and their characteristics interactions are basic requirement for any realistic or durable design of roads and other highway infrastructures (Shun, 2014).

2.2.1 Traffic Flow Information (TFI)

The traffic information of a particular area may be represented in different ways by means of statistical charts or graphs.

Some of these information are as follows:

i. Hourly Traffic (H.T): this refers to the total number of vehicles passing through a particular point of a road in one hour.

ii. Daily Traffic (D.T): this refers to the number of vehicles passing through a particular point of a road in twenty hour (24) hours.

iii. Average Daily Traffic (ADT): this refers to the average number of vehicles passing through a particular point over a duration of at least seven days (1 week).

iv. Monthly Average Daily Taffic (MADT): this refers to the average number of vehicles passing through a particular point of a road each day for a period of one month.

v. Annual Average Daily Traffic (AADT): this refers to the average of the daily traffic passing through a particular point of the road for a period of one year (365 days)(Rogers, 2013).

Due to the variations in the traffic flow which occurs through the day, week, month or season, it has been established that the longer the period which can be counted and included in the averaging process, the more reliable the statistics obtained indicates the true image or features of the road (Knittel, 2016).

The AADT has been reported to represent represents the most reliable indicator of the overall use of a road which takes account of daily, monthly or seasonal variation of traffic flow and

consequently provides the average at the end of the year. The MADT provides an indication of the use of the road which takes out the fluctuation of the traffic within the monthly and weekly cycles but does not account for the fluctuation in the monthly volumes. The ADT is an indication of the average use of a road which has eliminated the variations which takes place over a weekly cycle including the weekends but does not however consider any variation which may occur in different weeks of the month. The DT and HT in the other hands indicate the need for the data obtained from any long term count to be applied with certainty. The relationship between these statistical parameters are shown on equations 2.1 and 2.2

$$AADT = MADT/MTR \quad (2.1)$$

$$AADT = MADT*MTF \quad (2.2)$$

(Highway Design Manner, 2013).

2.2.2 Traffic Study

Traffic studies refer to the systematic way of understanding the general behaviour of the traffic system available or being witnessed within a specific highway or intersections. It is usually embarked upon so as to be able analyse the traffic characteristics of the study area. It is very vital as it helps in estimating and the design geometric control design that best suits a specific area of interest which generally aims at ensuring effective and efficient traffic movement in and ensures that futuristic traffic problems are identified early enough and designed for so as to avert its advert effect on the users of the road or other highway structures such as bridges or culverts and other related ones. The knowledge obtained from traffic studies also helps in understanding the best operating characteristics of the traffic of concern. Traffic study also provides some useful information which are essentially employed

at the planning and design phases of the traffic projects. It is also vital in determining the individual impacts of phase developments, and hence helps in selecting the best traffic signals for the study area and also helps to analyse the accessibility of traffic and other emergency mobility into the highway of interest (Moore, 2021).

The type of traffic study which is essentially carried out for the purpose of collecting data on the traffic is referred to as traffic census. It is mostly carried out to check if the carrying capacity of the road has been estimated and determine whether there is any need for expansion of the highway facility. Traffic study may be grouped into three (3) groups based on their characteristic similarities. They include:

i. Inventory studies,

ii. Administrative studies

iii. Dynamic studies.

(Shake, 1976)

i. **Inventories studies:** these are usually carried out in order to obtain a graphical display of existing information about an already existing traffic. Some of these vital information may include the street widths, parking spaces, transit routes and traffic regulations. For instance, some inventories consist of the available parking spaces and traffic regulations. These are basic information which can help in implementing the best traffic management options and as at when due. These information are however flexible and hence often change as traffic influx increases, hence in order to maintain sanctity of the road, these studies are usually expected to be carried out periodically of a realistic time length (Amott, 2006).

ii. Administrative studies: This entails the use of traffic engineering data which are at the government agencies disposal to predict the future behaviour of highway elements and where detrimental provide for its amelioration. The information obtained from this study are usually used to prepare the inventories of some relevant data which when implemented can help in effective management and administration of traffic systems within a locality. Administrative studies include the obtaining and analysis of survey results, which may involve field measurements and aerial photography of the interest area (Shun, 2014).

iii. Dynamic traffic studies: It involves data collection of traffic under operational conditions. It includes the studies of speed, traffic volume, travel time and delay, parking spaces, rate of traffic congestions and road casualties.

2.3 Traffic Volume Counts

This refers to the number of vehicles or pedestrians passing through a particular section of the road per unit time within a specific period of time. These information are usually obtained through traffic studies. Traffic volume is time dependent and therefore may be considered to be seasonal, especially in connecting highways. In order to obtain a reliable traffic volume information, the traffic study is expected to be carried between fifteen (15) minutes to as much as a year or even longer depending on the interest and the anticipated use of the proposed data (Hoel, 2009). In urban areas for instance, the maximum traffic volume usually occurs at the start and closing of schools, churches, offices, mosques or any other public gathering of large population. Traffic survey for peak hours will almost provide the necessary information required by the highway engineer for planning and management. While conducting the study, some stations are being mapped out at some strategic points of the road to act as reference points during and throughout the study. These points are expected to be the most hit traffic with worst scenarios on the road so as to be able to ascertain the characteristic

behaviour of the road under worst traffic conditions. Traffic volume study may also be referred to as traffic census. Traffic census is usually carried periodically. Depending on the information needed by the traffic manager, they study could be carried out on daily basis, weekly, monthly or even yearly (Adams, 2011).

2.4 Reasons for Traffic Counts

Traffic census or count could be carried out for different reasons or purposes, however, some of the most prominent of such have been identified to include; planning, design, improvement and dynamic traffic management purposes.

i. Planning Purposes: traffic study has been identified as an essential tool in obtaining accurate information on the amount of traffic on the roads which is very vital for the effective implementation of both road maintenance and improvement policies for optimal output. The traffic volume network analysis is usually used in deciding on the necessary policies that need to be implemented in order to ensure the necessary improvements which can enhance free traffic flow on the highways.

ii. Design Purposes: traffic count provides reliable information which are essentially needed in the structural and geometric design of road pavements, bridges, road intersections and other highway facilities design including the minimum turning path, channelization, flaring, and traffic control devices.

iii. Improvement Purposes: in order to improve the roadway operating conditions, it is important to know the traffic volume. This can only be achieved through a proper traffic count exercise. In order to ensure rational limit in traffic maintenance budget, it is essential to note the traffic volume carried by a particular roadway section so as to be able to decide on the relevance of the road, identify its lacking priorities and be able to fix them as at when due.

Also, traffic census is also essential in some other different areas of traffic maintenance as it equally helps in examining the existing operating or service condition of a roadway section. It is also used to check the need for traffic control devices which depends on some other factors such as economy, traffic volume, literacy and skilled manpower. It equally helps to determine the kind of improvement measures that are needed to be put in place in particular road section of the traffic. It also helps to measure the effectiveness of a traffic control measure which has been implemented over a period of time.

iv. Dynamic Traffic Management Purposes (DTMP): till date, traffic flow information is still being regularly identified as one of the ways through which traffic can be optimized on the highways. Traffic signal design has greatly been improved greatly and hence the junction performances and the intersection efficiency.

2.5 Traffic Volume Characteristics

Traffic volume counts are usually carried out when certain volume characteristics are required for one purpose or the other. Some of these features may include

i. Average Annual Daily Traffic (AADT) which refers to the average of 24-hour counts which is collected on daily basis within a year. It is expressed in volume per day (v.p.d). It may also refer to the average annual daily traffic report issued for different traffic analysis which include the estimation of the revenue generated from the users, the computation of crash rates in terms of number of crashes per 100 million vehicle miles .It is most usefully used for accident studies and analysis, traffic forecasting which involves the act of establishing traffic volume trends based on available results, evaluation of the economic feasibility of highway projects, development of free-way and major arterial street systems and

finally, it is used for the development, improvement and maintenance programs for the highway optimum utilization.

ii. Average Daily Traffic (ADT) which refers to the average of 24-hours count collected over a number of days. The exercise is usually carried out between one and three hundred and sixty five days. ADT is essentially used for highway planning activities. It is also used in the measurement of current demands on a given highway section. It is equally used in the evaluation of already existing traffic flow for effective monitoring and proper recommendations for effective management. Like other forms of traffic count methods, it is also used in estimating the Peak Hour Volume (PHV) of a traffic flow.

2.6 Traffic Engineering

This is a subordinate of the highway engineering which is concerned with the use of the available tools or skills include science and technology to plan some functional design s which are essential in effective operation and management of traffic facilities to suit the available mode of transportation and at the same time improve the socioeconomic activities within the society. Effective traffic engineering usually offers safe, efficient, rapid, comfortable, convenient, economical, and environmentally compatible means of transportation of people and goods and services from one point to another (O'Flaherty et al, 2006). As a branch of environmental engineering, it equally provides the society and the government (management team) in particular with efficient planning, geometric design and traffic operations of roads, streets and highways (Amos, 2011).

It is therefore rational to define traffic engineering as an art and which entails efficient estimation of traffic demand, the highway capacity, measuring and determination of the relationship which exists between traffic the different traffic variables and their applications

to planning, designing, operating and administering of highway facilities so as to achieve safe and maximum efficiency of the movement of people, goods and services within a given locality (Ekanem, 1997. The fundamental objective of traffic engineering is to ensure safe, free, rapid and efficient flow of the traffic users at all times without any detrimental effect on the general wellbeing of mankind or his environment.

2.7 Passengers Car Unit (PCU)

PCU is an acronym for Passengers Car Units. It is a term which expresses the traffic volume as a number of vehicles passing a given section of the road or traffic lane per unit time. It has been reported to be appropriate and efficient for use when several types of vehicles with varying static and dynamic characteristics are observed on the same traffic lane. It is heterogeneous in nature and this has often become a common problem associated with. This however can be addressed by converting the different types of vehicles into equivalent passenger car and expressing the volume in terms of passenger car unit (PCU) (Moore, 2021).

This method of traffic study has for decades now being considered and acceptable globally since the traffic can easily be studied by considering just the passenger-car relationship. (Amos, 2011).

2.7.1 Factors Affecting Passenger Car Unit (PCU) Values

Some of the factors that commonly affect the PCU values include:

i. transverse and longitudinal clearance between moving traffic vehicles.

ii. The stream characteristics of the traffic vehicle class composition, mean speed and the volume to capacity ratio.

iii. The vehicle operational characteristics features such as speed, acceleration and

the characteristics braking.

iv. Atmospheric and Environmental conditions of the study area.

v. The stream characteristics of the traffic vehicle class composition, mean speed and the volume to capacity ratio.

Table 2.1 shows the PCU values for different vehicle classes according to the Highway Capacity Manual as published by the Transportation Research Board, 2000.

Table 2.1: Passengers Car Unit for different classes of vehicles

S/N	**Vehicle class**	**PCE/PCU**
1	Animal driven carts	4.0
2	Motorcycle	1.0
3	Bicycle	0.75
4	Passenger car/Private cars	1.0
5	Large bus	3.0
6	Hiace /Coaster	3.5
7	2-AxleTruck	4.0
8	3-AxleTruck	4.5

(Source: TRB, 2000)

2.8 Types of Traffic Counts

Different types of traffic counts exist globally, however, the most popular ones include:

i. Periodic Volume Counts (PVC)

ii. Pedestrian Volume Count (PVC)

iii. Intersection Volume Count (IVC)

iv. Screen-line Volume Counts (SVC)

v. Cordon Volume Count (CVC)

2.8.1 Periodic Volume Counts

This type of traffic count is usually carried out in order to obtain certain traffic volume data, such as AADT. It is necessary to obtain data continuously however, it is not feasible to collect continuous data for a very long period since this exercise is cost intensive. Therefore, to make a reasonable estimate of an annual traffic volume characteristics on an area, different types of periodic counts, with count durations ranging of about 15 minutes to continuous are conducted. The data from these different periodic counts are then being used in the estimation of annual traffic characteristics of the study area.

2.8.2 Pedestrian Volume Counts

This entails the volume count of pedestrians which is usually carried out on specific locations such as midblock and crosswalks along highways. It is usually carried out when the already existing or proposed pedestrian facilities are to be undertaken. This often accounts for the counts to be used for crash analysis, capacity analysis, and determining the minimum signal timing and signal interventions.

2.8.3 Intersection Volume Count (IVC)

This type of volume count is usually taken in order to determine the different vehicle classes which move through a traffic and traffic intersections. The data obtained from this count are usually used in mainly in determining the phase lengths and cycle times in a signal effective intersections and in the design of channelized intersections in traffic engineering practices.

2.8.4 Screen-line Volume Counts (SVC)

In this type of traffic count, the study area is usually divided into large sections by running an imaginary line commonly referred to as screen line through it .In some instances, the man-made or natural features such as rivers or railway tracks are being used as the screen-lines. The traffic count are usually conducted at the points where the road crosses the screen line.

2.8.5 Continuous Volume Counts (CVC)

In this type of volume counts, counts are usually taken continuously using electronic, mechanical or any other automated device which counts the traffic and displays the data obtained autonomously on the display screen. This device is usually placed at a reference point usually referred to as permanent count station. In selecting the permanent count stations, the highways within the study area firstly classified very properly so as to ensure the efficiency and reliability of the study.

2.8.6 Methods of Traffic Count

There are two basic methods of conducting traffic counts. They include the direct and manual methods.

2.8.6.1 Direct Method

This is the simplest method of traffic count. In this method, the observer simply counts the number of vehicles, their types or brands passing through a chosen section of highway within a specified period of time. For Light Volumes, tally marks or any other form of statistical representation can be used to represent the data in a way that it can easily be interpreted (Mohammed, 2009).

2.8.6.2 Manual Volume Counts

In this method of traffic count, the volume count requires a traffic surveyor who stands on the roadside counting and classifying vehicles as they pass and by dividing the survey into fixed periods. Manual method of counting can be classified into two. They include; they include the direct method and the indirect methods. This method requires a routine count (Hoel, 2009). Data from the annual counts can simply be recorded using tally sheets on which counts can be recorded with some marks on the specially designed sheet or board.

2.8.6.3 Automatic Volume Count

This involves the use of automated devices in carry in carrying out traffic counts. The observations of volume of auto presence and occupancies of road has been performed more effectively through the means of automated traffic count systems The utilization of modern technologies in the electromagnetic applications , that wireless communication systems have allowed for better traffic observations globally and so, it has been reported to be an effective mode of counting. (Odifiri, 2017).

2.8.6.3a Advantages of Automatic Count

Some of the advantages of Automated Traffic Count includes:

i. It is suitable for long duration or continuous count.

ii. It can be used as permanent counting station.

iii. In a long run it is less expensive than the manual count method since no manpower or special skill is required.

iv. It does not require manpower and it is free from human error.

v. Data obtained are usually in measurable format.

vi. It is not usually affected by atmospheric conditions.

2.8.6.3b Disadvantages of Automatic Count

i. It requires strict lane discipline

ii. It is hard to detect any non-motorized object on the road by this method.

iii. Detailed classification of vehicle is not as possible as in the case of manual method.

iv. It is surprising but yet true that the accuracy of that method is less than that obtained from the manual method.

2.9 Highway Capacity and Level of Service

Highway capacity simply refers to the highest traffic flow rate which a given roadway can support without any detrimental effect on the road users including vehicles and pedestrians (Rogers, 2013). Traffic volume and capacity are measures complementary parameters which measure the traffic flow of a given road section. Volume represents the actual traffic flow rate and it depends majorly on the variations in the traffic demand while the capacity refers to the maximum rate of flow that can be carried by a given roadway. For efficient rate of flow to be achieved on the roadways, the traffic volume on the road must be less than the capacity. The

capacity of a roadway has been reported to be affected by different factors affected by many factors including the lane width, number of lanes, ,presence of merge and weave segments, weather, roadway alignment and both width and type of shoulder. In addition to these factors, periodic traffic variation and traffic demands also affect the capacity of the roadway and must be taken into consideration while estimating the capacity of highway.

For typical conditions and to balance financial, safety and operational considerations must be recommended and implemented within the limits of the available economic reality of the society (Traffic Design Manner, 2013).

According to the Highway Capacity Manual (HCM), published by the Transportation Research Board in the year 2010, the Level of Service is a very essential and critical factor which must always be given adequate attention during design and planning of any roadway or traffic highway.

2.10 Traffic Congestion

As earlier noted, traffic congestion refers to the gridlocks often witnessed on the road as result of the expected traffic demanding exceeding the available carrying capacity of the designed highway. For this situation, the line length of the highway may be expanded periodically so as to ensure that the required length of the roadway intersection is achieved at a sustainable rate (Odifiri, 2017).

As traffic demand approaches the capacity of a road or intersection on the road, extreme road congestions is being experienced. Traffic congestion is usually as a result of poor management or ineffectively planned traffic system which can also be as a result of lack of modern technology or skilled personnel (Zadobrischi, 2016).

2.10.1 Causes of Traffic Congestion

Traffic congestion can be caused by one or combination of the followings

i. traffic overload of a route.

ii. road works such as constructions.

iii. road crash or accident.

iv. large number of pedestrians holding up vehicles.

v. any other obstacles on the roads.

2.10.2 Effects of Traffic Congestion

Some of the effects created by traffic congestions on the highways include one or combination of the followings:

i. increase in travel cost.

ii. delay in travel time.

iii. decrease in mobility.

iv. lack of accessibility of some locations.

v. environmental degradation such as air pollution and global warming.

(Downs, 2005).

CHAPTER THREE

METHODOLOGY

In this chapter, attention is being paid on the more effective means of getting more elaborate information on the designated area of study. In thus chapter also, a better understanding about the study will be developed, particularly on how the research was being conducted and other vital information which shall also be detailed within the chapter. The most important thing in a research is usually the process and the accurate interpretation of the obtained data so as to showcase the obtained result as being through with clear and reliable evidence. Generally, there are two most common methods of carrying out a research; they include the qualitative and quantitative methods, though, some researches often combine the two methods. This research employed the quantitative method which involved the administration of a set of questionnaire sample on some targeted respondents. This was done in order to obtain reliable and direct information from reliable sources, which included the direct traffic or users of the road intersection at the UBTH junction. The quantitative approach adopted in this research also created some easier ways through which data can be collected, arranged and the tools and equipment which are deployed in the analysis of the important data on the research topic. Apart from making some references to secondary sources, data for this study were basically primary in origination since they obtained from the direct source. However, both fieldwork and questionnaire administration were both used in sourcing the needed data for the study. During the fieldwork, data collection was limited to route way studies, traffic flow pattern and the volumetric traffic analysis of the intersection of interest. For the identification of the factors which are responsible for the traffic congestion frequently experienced on the intersection, a total of one hundred copies of a well-structured questionnaire were distributed randomly to the commuters who ply through the intersection junction. This is because, they frequently ply the route and therefore are believed to be knowledgeable about the causes and the effects of the traffic congestion on the socio-economic activities and the general lifestyle

and the total well-being of the people who ply the route frequently and the general public in general.

3.1 Description of the Study Area

UBTH Junction is one of the busiest road intersections in the Benin-City metropolis. It is the major exist for the popular University of Benin Teaching Hospital which leads people out of the hospital into the heart of the city. It is an intersection which connects the hospital to the Benin-Lagos Expressway and the Uselu axis of the city. It is located in Egor Local Government Area of Edo state. The intersection is on a trunk A (Federal) road. It is a U-turn point for traffic from the University of Benin axis and those from the Uwasota axis within the same Local Government Area.

Fig 3.1a showing traffic at the UBTH Junction (source: Google map)

3.1b showing image of the study area

3.1.1 Ugbowo-Lagos Expressway

This road is a trunk A road which implies that it is being owned and maintained by the Federal Government of Nigeria. It is located in the Ovia North East Local Government Area of Edo state. It spans from the Oluku axis (6.304675 Latitude, 5.104605 Long) to the popular

Uwasota junction (6.424675 Latitude, 5.114603 Long) spanning over an approximate distance of about 2.61km. It is 6m wide on both carriages with a service lane on both carriages each of about 4m wide. Traffic on this road is usually controlled by the traffic wardens from the Nigeria Police Force as no functional traffic signals have been installed on the road. Due to the easy accessibility of the road, the area within the road is with A level of service grade E with an average inter vehicular range of 35-49m is a federal government's dual carriage highway. The road constantly experiences high traffic due to the constantly increasing number of vehicles and other traffic components which apply the road every day for almost twenty four hours per day. The traffic often reaches its peak and even sometimes result into heavy traffic congestion. One of the contributors to that effect is the University of Benin and the University of Benin Teaching Hospital which are strategically located along the road. Other public and private infrastructures that also contribute to the gridlock include the Cocoa Cola company located on the Oluku, the St. Patrick's Catholic Church, Ugbowo, banks and other commercial areas, the Christ Apostolic Church and so on.

3.2 Study Reconnaissance

The first stage of the study is the collection of the data. In this study, this stage involved the surveying of the study area. The study site was visited to ascertain the actual state of traffic on the intersection point. The survey process included both the passer-by, residents and the visitors within and around the study area. The survey was carried out on the UBTH intersection to the Benin-Lagos Expressway. The study was carried out for a period of five days, three of which were working days (Wednesday, Thursday and Friday) while two ere weekend days (Saturday and Sunday). It lasted between November 16th and 20th, 2022. The study was carried out on consecutive days in order to ensure that good data flow procedures were obtained and reliable recommendations made at the end of the study. For each of those

five (5) days, the study lasted between 8am and 7pm. The period of the study was extended across the major strategic periods of the days in order to be able to determine which of the periods of the day does the traffic attain its peak on an average measure. Clear observations were kept throughout the study and proper records being kept so as to avoid any mishandling of the data obtained and to ensure they were properly and effectively recorded.

3.3 Method of Data Collection

The data needed for the completion of this research were obtained from the primary source of the traffic point or intersection of study. The primary sources included both the administration of questionnaires and visual observation of the traffic.

A set of questionnaires consisting of a number of unique questions were randomly administered on a selected number of passer-by and the drivers. The respondents were selected at random in order to ensure efficiency in the collection of the data and hence accuracy in the analysis of their analysis. Also, by visual observation, the number of the traffic (vehicles and pedestrians) was counted which ply the intersection point of study within a specific period of time. The counting was done manually and the traffic volume recorded periodically on the record sheet.

The study method of traffic count was adopted in the study because it is the most common method of achieving the actual traffic volume on a particular road, pavement, intersection or any other traffic structure. It involved grouping of the vehicles which pass through the intersection of study into groups according to their sizes and amount of loads which they carry per trip. The number of any group which passes through the intersection was recorded accordingly periodically. For faster record taking, the tally system was employed where the

cars were represented on bundles of four (4) tallies and a stroke. The bundles were later counted and their actual numbers represented as counting or natural numbers.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND DISCUSSION OF RESULTS

4.1 Traffic Count on the UBTH UGBOWO LAGOS ROAD

Table 4.1 shows the summary of the total result obtained from the traffic count on the University of Benin Teaching Hospital (UBTH) ROAD after a period of 7DAYS from on the 3rd OF JANUARY TO 9th OF JANUARY .

Table 4.1a: Traffic count obtained on TUESDAY

Days	**Type of vehicle**					
	Car	**2-wheel**	**3-wheel**	**4-wheel**	**5-wheel**	**Weather Condition**
6am-8am	1688	1397	284	434	231	Sunny
8am-10am	1504	1451	302	420	224	Sunny
10am-12pm	1517	1690	322	314	214	Sunny
12pm-2pm	1412	1314	213	441	321	Sunny
2pm-4pm	1700	1950	236	945	320	Sunny
4pm-6pm	1800	1689	456	467	301	Sunny
Total	9621	9491	4373	3021	1 611	28117

Table 4.1b: Traffic count obtained on WEDNESDAY

Days	Type of vehicle					
	Car	**2-wheel**	**3-wheel**	**4-wheel**	**5-wheel**	**Weather Condition**
6am-8am	1526	1310	214	321	260	Sunny
8am-10am	1510	1361	219	402	236	Sunny
10am-12pm	1541	1331	241	313	217	Sunny
12pm-2pm	1740	1329	220	341	222	Sunny
2pm-4pm	1840	2056	228	369	209	Sunny
4pm-6pm	2098	2579	281	210	201	Sunny
Total	10255	9966	1 403	1 956	1 345	**15955**

Table 4.1c: Traffic count obtained on THURSDAY

Days	Type of vehicle					
	Car	**2-wheel**	**3-wheel**	**4-wheel**	**5-wheel**	**Weather Condition**
6am-8am	1521	1308	231	404	235	Sunny
8am-10am	1513	1372	322	416	244	Sunny
10am-12pm	1525	1351	328	321	218	Sunny
12pm-2pm	1532	1314	213	441	321	Sunny
2pm-4pm	1872	1987	233	424	342	Sunny
4pm-6pm	2510	2208	373	224	362	Sunny
Total	10473	9540	1 700	2230	1 722	25665

Table 4.1d: Traffic count obtained on FRIDAY

Days	**Type of vehicle**					
	Car	**2-wheel**	**3-wheel**	**4-wheel**	**5-wheel**	**Weather Condition**
6am-8am	1518	1369	214	451	243	Sunny
8am-10am	1512	1468	219	426	244	Sunny
10am-12pm	1525	1351	202	413	218	Sunny
12pm-2pm	1508	1347	213	419	212	Sunny
2pm-4pm	1735	1911	261	222	335	Sunny
4pm-6pm	2510	1960	303	216	301	Sunny
Total	8800	9406	1412	2147	1 553	23318

Table 4.1e: Traffic count obtained on SATURDAY

Days	**Type of vehicle**					
	Car	**2-wheel**	**3-wheel**	**4-wheel**	**5-wheel**	**Weather Condition**
6am-8am	1520	1309	234	461	212	Sunny
8am-10am	1514	1301	314	432	240	Sunny
10am-12pm	1515	1310	322	313	214	Sunny
12pm-2pm	1535	1319	210	401	229	Sunny
2pm-4pm	1941	1962	206	218	200	Sunny
4pm-6pm	2514	2306	270	212	217	Sunny
Total	10539	9507	1 556	2 037	1 312	**24951**

Table 4.1f: Traffic count obtained on SUNDAY

Days	**Type of vehicle**					
	Car	**2-wheel**	**3-wheel**	**4-wheel**	**5-wheel**	**Weather Condition**
6am-8am	1690	1313	224	417	201	Sunny
8am-10am	1567	1311	314	410	222	Sunny
10am-12pm	1521	1319	302	316	209	Sunny
12pm-2pm	1517	1318	210	401	311	Sunny
2pm-4pm	1911	2315	230	424	317	Sunny
4pm-6pm	2504	2501	371	213	321	Sunny
Total	10710	10077	1 651	2 181	1 581	26200

Table 4.1g: Traffic count obtained on MONDAY

Days	**Type of vehicle**					
	Car	**2-wheel**	**3-wheel**	**4-wheel**	**5-wheel**	**Weather Condition**
6am-8am	1512	1327	264	411	241	Sunny
8am-10am	1523	1371	332	415	254	Sunny
10am-12pm	1530	1315	302	317	212	Sunny
12pm-2pm	1500	1316	272	414	301	Sunny
2pm-4pm	2511	2312	240	221	321	Sunny
4pm-6pm	2710	2232	250	223	311	Sunny
Total	11286	8557	1 660	2 001	1 640	**25144**

The results on table 4.1a-4.1g show the values of the traffic count obtained from the traffic study which was conducted on the intersection of the University of Benin Teaching Hospital for a period of 7 days between the hours of 8am and 6pm daily. The highest morning volume count (8am-12pm) recorded was 1690. The highest afternoon (12pm-4pm) volume count recorded was 2511 while the highest evening (4pm-6pm) volume count recorded was 2710. The higher volume of traffic plying the intersection is attributed to the frequent departure and return to their residence or places of work or businesses within these periods while the lower volume recorded in the afternoon can be attributed to the fact that most of the traffic population were at the working places within this period which comprise most of the working periods of the day.

4.1.2 Determination of the Average Daily Traffic (ADT) of the intersection

Average Daily Traffic, ADT

28117 +15955+25665+23318+24951+26200+25144= 169350/7 =24193veh per day.

This result shows that for a typical condition and also in order to balance the financial, safety and operational conditions, it is very essential for the capacity of the adjoining road to the intersection to be taken as between 200 and 450veh/day on average while for freeways, considerations could be given to vary from four lanes to six lanes freeways when the traffic flow is of the order between 300 and 415veh/day. Since the adjoining road is a two lane road, the obtained ADT has exceeded the recommended.

Also, within the period of the study, the Peak Hour(P.H) of the traffic was observed to be between 8am and 10am since that was the interval within which the peak traffic of 567 was obtained on the first day of the study. This high figure can be attributed to the fact that the

first day of this study was the resumption of work for civil servants and other related workers after the christmas and new year celebrations.

4.1.3CAPACITY AND LEVEL OF SERVICE

The design capacity of a freeway (express way) is 2400veh/day/lane (HCM 2000). At peak hours , the volume of traffic on the road exceeds 2400/veh/hr/lane leading to traffic congestion while at non-peak hours ,where the volume of the traffic is below 2400veh/hr/lane ,there is free flow of traffic .

4.2 Categorization of the Nature of the vehicles plying the intersection

In order to ascertain the major causes of traffic congestions on the road, the nature of the vehicles counted along the intersection needs to be recorded and be analysed. The categorization is shown on table 4.2.

Table 4.2: Categorization of vehicles plying the route of study

Time/Type of Vehicles	**Cars**	**2-axle**	**3-axle**	**4-axle**	**5-axle**	**Total**
6am-8am	1257	1432	341	430	73	3533
8am-10am	1210	1319	335	349	322	3535
10am-12pm	1321	1238	224	221	242	3246

12pm-2pm	1472	1164	310	319	167	3432
2pm-4pm	2186	2210	106	330	322	5154
4pm-6pm	2311	2370	257	121	409	5468
Total	9757	9733	1 573	1 770	1 535	**24368**

Table 4.2 shows that for the period of this traffic count on the intersection, maximum traffic was obtained between 4pm and 6pm with a total volume of 5468. 4-axle or wheel vehicles were observed to pass through the route most with a total number of 1770 vehicles. While 5-axle vehicles had least total volume of 1 535 within the period of the study.

4.3 Analysis of the Questionnaire Administered

A total of 100 copies of questionnaire were administered but only 94 of them were recovered back. The remaining 6 copies were lost to the traffic as some drivers drove off their copies.

4.3.1 Gender Distribution of the Respondents

Out of the 94 recovered copies, 53 Respondents were female while 41 were males.

Table 4.3 showing the gender distribution

Gender	**Number of Respondents**
Male	41
Female	53

4.3.2: Profession of the Respondents

The questionnaire was administered on members of different professions. This was as showed from the response obtained from the questionnaires. The distribution is shown on table 4.4

Table 4.4 The professions of the respondents

Profession	Number of Respondents	% Representation
Bus Driver	27	28.72
Taxi Driver	13	13.83
Trader	19	20.21
Engineer/Technician	5	5.32
Banker	8	8.51
Electrician	11	11.70
Teacher/Lecturer	15	15.96
Unclassified	6	6.38
Total	94	100

The response shows that most of the traffic vehicles that ply the study area ae used for commercial purpose as bus drivers and taxi drivers take a total of 42.55% followed by traders who make up 20.21% of the traffic.

4.4 Causes of Traffic Congestion on the study area

Table 4.5 shows the distribution of the causes of traffic gridlocks on the study area.

Table 4.5: The causes of traffic jam on the UBTH intersection

Causes	Number of Respondents	% Representation
Poor Driving Habits	16	17.02
Poor Parking Habits	11	11.70
Poor Road Network	2	2.13
Inadequate Road Capacity	3	3.19
Lack of Parking facilities	7	7.45
Poor Traffic Control	3	3.19
Poor Drainage System	1	1.06
Presence of Heavy Vehicles	12	12.77
Poorly Designed Road Intersection	7	7.45
Lack of Efficient Mass Transit	7	7.45
Lack of Pedestrian Facility	4	4.26
Malfunctioning Vehicles	14	14.89
Poor Road Pavement	6	6.38
Presence of Construction works	1	1.06
Others	2	2.13

The result obtained shows that the greatest part of the traffic congestion is being caused by Poor Driving Habits on the side of the driver and broken down vehicles which are not being properly and promptly cleared from the road.

4.5 Suggested Remedies to Traffic Congestion on the Study Area

Few solutions to the traffic congestion were suggested by the respondents. These are shown on table 4.6.

Table 4.6: The remedies to traffic congestion on the road

Suggested Remedies	Number of Respondents	% Representations
Proper parking	12	12.77
Provision of pedestrian facilities	10	10.64
Provision of interchanges (flyovers and overhead bridges)	15	15.96
Proper traffic management plan	12	12.77
Adoption of public mass transit	3	3.19
Mass Communication	9	9.57
Maintenance	5	5.32
Re-routing of heavy duty vehicles	7	7.45
Enforcement of traffic rules and regulations	13	13.83
Provision of good road network	8	8.51
Total	94	100

The result obtained shows that the best remedy to the traffic congestion and for ensuring good traffic flow through the study area is the provision of interchange structures such as overhead bridges and flyovers with 15.96% acceptance over other remedies suggested.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study has showcased the causes and some possible remedies to traffic congestion on the University of Benin Teaching Hospital's intersection. The main causes were identified to include insufficient road capacity, improper traffic management and lack of adequate traffic facilities. This implies that the causes are man-made and can be prevented. The study has also suggested some possible remedies to the ugly incidence, hence, it can be concluded that despite the large volume of traffic witnessed on the study area, with proper planning and

implementable policies coupled with the provision of necessary skills and facilities, the traffic congestions frequently experienced on the study area can be contained and the traffic volume managed very effectively for the economic benefits of the city and the state in general.

5.2 Recommendations

From the conclusions made based on the results obtained from this study, the following recommendations can be made towards improving the traffic condition of the study area.

1. Well design roundabout should be constructed on the intersection to prevent undue interception of vehicles.

2. Interconnecting roads to the study area should be properly planned to reduce the volume of traffic connecting directly to the intersection.

3. Proper traffic planning and management should be encouraged on the study area.

4. More traffic personnel should be deployed to the intersection especially in the early morning and evening when the traffic tends to attain its peak volume.

5. Public mass traffic system should be encouraged in the city to reduce the number of vehicles on the road at a time while still conveying people and their goods and services to their required destinations within a shorter period.

6. Government should implement stiffer measures on the traffic offenders without any favouritism in order to ensure better compliance to traffic rules and regulations.

7. The traffic study should be carried out on the intersection periodically in order to provide any needed maintenance service at the right time to ensure smooth flow of traffic.