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DECLARATION

I hereby declare that this dissertation is my own work. Neither the material nor any part of the thesis has been submitted in the past, or is being, or is to be submitted for a Degree at the University of Zambia or any other University. All published work or materials from other sources incorporated in this dissertation have been acknowledged and adequate reference thereby is given.

I, therefore, present the dissertation for examination for the award of a Degree of Master of Science in Spatial Planning to The University of Zambia.

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October, 2018

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APPROVAL

This dissertation of Sydney Chipili has been approved as fulfilling the requirements for the award of Master of Science in Spatial Planning by The University of Zambia.

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Chairperson

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Board of Examiners

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Supervision

DEDICATION

To

My mother, Beatrice Chipili who has always been there for me and ensured that I attain success in my education journey

My late Auntie Astridah Chipili Zgambo and my late grandmother Elizabeth Mwenya Phiri who supported my education whilst they were alive

.

ABSTRACT

The aim of the study was to examine the problem of parking facilities in the Central Business District (CBD) of Lusaka City. The objectives of the study was to assess the existing capacity of parking facilities in the CBD, to ascertain the volume of traffic at different locations, days, times and directions for Lusaka CBD, and to assess the adequacy of the governing legislation and regulations for parking.. A questionnaire was administered to 60 conveniently sampled motorists along Cairo Road, Chachacha Road, and Freedom Way. An interview guide was used for the following purposively sampled key informants; Lusaka City Council, Road Transport and Safety Agency, Parkrite Zambia Limited and Parking Marshals. Hourly Traffic counts were done on seven (7) entry points to the CBD for Seven days of the week, at 07:30-08:30, 12:30-13:30 and 15:30-16:30. The data on parking capacity were analysed using descriptive statistics, while the ANOVA test was used to analyse traffic volumes. Content analysis was used to analyse parking legislation.

The study revealed that the CBD has 2800 functional parking spaces out of the 4598 available spaces. This is as a result of some parking spaces being turned into taxi ranks, minibus stations, motor repair garages, and permanent structures that are erected on the spaces as trading areas. Only 9.7 percent of the functional parking spaces are off-street parking spaces. Parking spaces have no parking signs, drainages in car parks are blocked, and vehicle security is not provided in car parks.

The study established that traffic volumes are higher on weekdays than weekends. This means that there is a higher demand for parking spaces than the supply (4598 parking spaces) in the CBD. On average, the CBD receives 44221 vehicles on working days, higher than weekends that receive 26074 vehicles, and this calls for proper management of the 4598 parking spaces provided in the CBD. In terms of traffic volumes for various times of the day, it was found that time is insignificant as traffic volume do not differ (p=0.816), meaning that traffic volumes are constant throughout the day. Furthermore, the results showed that traffic volumes differ at different localities (p = 0.0001). What came out is that the Kabwe and Kafue roundabouts receive more volume of traffic than any other location. The results further revealed a significant difference (p=0.001) between the traffic going in and going out with less traffic volume going out of the Lusaka CBD. This implies that for vehicles that enter Lusaka CBD, some remain there and demand parking space.

It was further found that the legislations that are related to parking provision, management, regulation, enforcement, and pricing are not adequate. They lack provisions on detailed car park design, parking services such as cleaning services, car repairs, roadside trading, taxi ranks, car trading places, car washing, and car security service. Worse still, there is no mechanism in place to determine the parking price. The city has no parking policy to operationalise the legislations which make enforcement difficult. Therefore, it is as a result of these factors that the parking problem exists in the CBD of Lusaka City. If left unchecked, they will affect the performance of the city in terms of vehicle circulation. Thus, the study recommended that there is need to create more off-street parking spaces, encourage shared parking, amend the legislations, develop a parking policy and strengthen enforcement of the law.

Keywords: Central Business District, Parking Capacity, Traffic Volume, Parking Legislation

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of Variance
CBD	Central Business District
CSO	Central Statistics Office
DDAT	District Department of Transportation
GRZ	Government Republic of Zambia
ITE	Institute for Transportation Engineers
JICA	Japan International Cooperation Agency
LADOT	Los Angeles Department of Transportation
LCC	Lusaka City Council
NEPA	National Electric Power Authority
NYCDOT	New York City Department of Transportation
OFP	Off Street Park
PCU	Passenger Car Unit
RAC	Royal Automobile Club
RTSA	Road Transport and Safety Agency
ZMW	Zambian Kwacha

CHAPTER ONE

INTRODUCTION

This chapter is divided into six sections. Section one, provides the background to the research, while section two presents the research problem. Section three, four and five define the aim of the study, objectives and research questions that guided the study, respectively. Section six, presents the significance of the research by explaining the potential use of the research product.

1.1 Background

Transportation is a process that involves the movement of commuters, goods, and services from a given point of origin to a specific destination (Okoko, 2006). It is a means to access business activities, education, employment and recreational opportunities (World Bank, 2002). Talvitie (1997) opined that urban transport is very crucial because it facilitates the movement of people and goods, which marks the backbone of economic growth and sustainable development of a country. The increasing population and expanding urban centers hasseriously compromised existing transportation systems and significantly increased the challenge of creating future transportation systems especially in developing countries (Aderamo, 2012).

However, urbanization is increasing at an alarming rate with 50 percent of the world population expected to be living in urban areas by 2025. More transformation is expected in developing countries (World Bank Report, 2003). With rapid urbanization and economic growth, motorization has been accelerating in cities of the developing countries. This rapid urbanization with its increase in both vehicular and human population is foreseen to affect sustainable development through its negative consequences such as traffic congestion, traffic accidents, and traffic noise pollution; and other transport infrastructure such as parking spaces.

Parking, an integral component of the transport system, is becoming a serious problem that confronts the urban planner and traffic engineer as it plays a crucial role in the management of traffic and congestion mitigation. Any vehicles traveling on highways will at one time or another be parked for either a relatively short time or a much longer time, depending on the reason for parking. The provision of parking

facilities is, therefore, an essential element of the highway mode of transportation (Oyedepo, 2016).

However, Ligocki and Zonn (1984:355) argue that a lack of understanding by planners of parking dilemmas can lead to the creation of further parking problems. They call for the development of a unit of individuals that will help regulate and monitor the dynamics of the Central Business District (CBD) in relation to parking. This, they postulate, can only be achieved through a thorough and continuous assessment of the nature of parking. This need for a better understanding of CBD parking is also recognised by Salomon (1986:200) who explains that to 'predict and provide' for parking spaces is a common mentality which he finds to be impractical in many cases. He argues that it "requires massive capital investments for acquiring land, for construction and, as supply increases, demand increases follow, with the associated congestion, pollution, energy, and safety side effects."

Ogunbodede and Ogundare (2014) mention that the inadequacies of parking supply are due to poor urban planning and encroachment on existing parking spaces. On the demand side, there has been a tremendous increase in the number of vehicles and this has created a high demand for parking spaces. As parking supply falls, and parking demand rises, the degree of parking deficiency increases. The consequences of this high parking deficiency are; total blockade of roads in some cases, narrowing of available road spaces, reduced vehicle speed, increased travel time, as well as slow to almost impossible emergency and rescue operations.

One of the issues that an undersupply can lead to is that of in-users driving about searching for a space to park in. This is not only frustrating, but also time consuming. As car parking forms a crucial part of the transport system (Litman, 2011), the issue of searching for an available car parking space seems, not to be a new one (Gomes, 1986). However, it remains unresolved (Qian and Rajagop, 2013). Such persistence could infer that the challenge of finding an available space to park in is not a straightforward one to overcome. Thus, making a choice of where to park your car becomes a complex process that is influenced by many factors.

It has been asserted by Thompson and Richardson (1996) that parking choice behaviour could be considered as a search-process in which parking users make a series of relative decisions based on their own experience and the conditions

provided by a specific parking place. When a motorist is deciding whether or not to park at the usual parking place, he/she will firstly evaluate the conditions of the car park. A number of factors can influence a user's parking decision; travel time to parking places, availability of parking spaces, ease of entering or exiting the car park, walking time to destination, the distance to pay machines, pricing, parking type, and perception of safety or comfort by the users of parking spaces (Diallo *et al*, 2012; Thompson and Richardson, 1996 Weant and Levinson, 1990). Therefore, it is important to understand the behaviour of motorists in a rapid urban centre where there are high volumes of traffic.

Traffic engineers and planners need information about traffic for various reasons: 1) To design and manage road and traffic system. 2) For planning and designing traffic facilities, selecting geometric standards, economic analysis and determination of priorities. 3) To justify a warrant of traffic control devices such as signs, traffic signals, pavement markings, school, and pedestrian crossings. 4) To study the effectiveness of introduced schemes, diagnosing given situations and finding appropriate solutions, forecasting the effects of projected strategies, calibrating and validating traffic models. Therefore, to manage the demand for parking spaces, a traffic survey is inevitable.

The main purposes of a traffic survey are: traffic monitoring, traffic control and management, traffic enforcement, traffic forecasting, model calibration and validating, etc. One major part of traffic studies is parking supply and demand studies (Halder *et al*, 2013). Traffic volumes are used to assess the impact of parking/unparking on thought vehicles. The analysis of parking durations could be utilised to form a parking control mechanism. It is expected that this information would be useful in developing parking control and management schemes to minimise abusing parking behaviour within CBDs (Yue, 2004).

Therefore, one factor to control and manage parking demand is to greatly tighten of laws and regulations governing parking (Diallo *et al*, 2012). Meanwhile, Oyedepo (2016) adds that the ineffective regulation on parking has further worsened the situation of congestion in most Nigerian cities. However, inadequate or improper management of parking spaces, as well as ineffective law enforcement has compelled many to park along the road including the public transport operators. Strategies such

as effective communication, parking enforcement, operational efficiency and provision of parking signage for better and efficient management of off-street parking should be adopted.

Lusaka City is the largest urban districts in Zambia with no rural population and its population has been increasing from 886,728 in 2000 to 1,747,152 in 2010 and it is projected to be 2,475,783 by 2030 (CSO, 2014). This development has led to an increase in vehicle ownership. Vehicle population in Lusaka has increased in the last 15 years from 181,000 in 2001 to 344,014 in September 2016 out of a total of 688,028 registered vehicles nationwide (RTSA, 2016). The resulting effect has been congestion on roads and inadequate parking facilities, particularly in the CBD. In addition, Lusaka CBD has a range of shopping malls, markets, informal commercial activities and Offices (LCC, 2008). This makes it attractive for both vehicular and pedestrian traffic resulting in parking problems. Therefore, this study is an attempt to examine the problem of parking in the Lusaka CBD with the view of suggesting alternatives for parking.

1.2 Problem Statement

The Lusaka CBD has severe parking problems which have been stimulated by an increase in both human and vehicle population. The resulting effect of this increase is that it has become very difficult to find parking space in the CBD. A lot of time is wasted in searching for parking space, thus leading to an increase in traffic congestion. Consequently, the city becomes inefficient and hard to live in due to the increase in the amounts of gas emissions released into the atmosphere. Illegal parking is also a major problem in the CBD. Roadside parking has become a common phenomenon that is reducing the traffic corridors meant for the efficient movement of automobiles. This in turn causes an increase in the cost of travelling. Therefore, this study focuses on examining the problem of parking spaces in the CBD of Lusaka City in order to understand the integral parts needed to resolve the mismatch between parking supply and demand. This is because no study was found to have been done in the study area.

1.3 Aim

The aim of this research was to examine the problem of parking facilities in the Central Business District of Lusaka City

1.4 Objectives

1. To assess the existing capacity of parking facilities in the CBD
2. To ascertain the volume of traffic at different locations, days, times and directions for Lusaka CBD
3. To assess the adequacy of the governing legislation and regulations for parking as it applies to Lusaka CBD

1.5 Research Questions/Hypotheses

1. What is the current capacity of parking facilities in the CBD?
2. In any attempt to ascertain the volume of traffic at different locations, days, times and directions for Lusaka CBD, the null hypotheses below were tested as part of the findings of this research:
    i. Ho: there is no significant difference in the mean hourly traffic volumes on different entry and exit locations for Lusaka CBD
    ii. Ho: there is no significant difference in the mean hourly traffic volumes for different days of the week
    iii. Ho: there is no significant difference in the mean hourly traffic volumes at different times of the day
    iv. Ho: there is no significant difference in the mean hourly traffic volumes for going in and out of the CBD
    v. Ho: Location, day, time and direction do not interact to affect the mean hourly traffic volumes
3. How adequate are the current legislation and regulations that guides parking in the CBD?

1.6 Significance of Study

Results from the study will help planners and city authorities to plan for better and adequate parking facilities. It will give guidance to policy makers on how to come up with better strategies to deal with parking problems. The study will also help planners to understand integral parts such as parking behaviour, traffic volumes and parking legislations that are needed to resolve a mismatch between parking supply and demand. Further, it will act as a basis for further research.

1.7 Organisation of the Dissertation

This dissertation is organised as follows: Chapter One provides the Introduction, the Problem Statement, the study Aim, Objectives, Research Questions/hypotheses, Significance of Study and the organisation of the dissertation. Chapter Two reviews the literature on the topic. Chapter Three describes the study area in terms physical and socio-economic characteristics, historical background and its main features. Chapter Four outlines methods used in the study including research design, data collection methods, sampling procedure, data analysis, ethical considerations and limitations of the study. Chapter Five presents the study findings and discussion of the results. Chapter Six provides the conclusion and recommendations of the study.

CHAPTER TWO
LITERATURE REVIEW

This chapter will look at literature on studies that have been conducted on parking problems and strategies used to improve parking. The chapter will highlight the concept of demand and supply in parking that explains and understand issues of parking capacity, and parking behaviour. It will further discuss the interaction of time, day and location and their effect on traffic volume in relation to parking. Lastly, it will focus on legislations that govern parking in some cities of the world.

2.1 Defining car parking

Firstly, there is the term 'parking' which can be used to describe *two* different factors (Palmer and Ferris, 2010; Jackle and Keith, 2004);

1. The infrastructure provided for the storage of vehicles; and
2. An activity forming part of the overall process of car travel

Secondly, there are car parking spaces and car parks. For the purposes of this study, the above description of car parking will be used according to which of the two contexts are applicable. Additionally, the following definitions by Beetham (2010) will also be assumed;

1. Car parking Space: An area reserved specifically for the purpose of accommodating a single parked car within a defined structure or surface area that is usually subject to a revenue, permit or time restriction policy
2. Car Park: A manned or unmanned, defined structure, underground or surface area that comprises spaces specifically reserved for the purpose of parking vehicles in and that is usually subject to a revenue, permit or time restriction policy

Car parking is recognised as being able to generate and attract demand (Smith, 2001). Once spaces become available, they can become vulnerable to restrictions imposed through policies designed to cultivate efficiencies within the transport network (Marsden, 2006). Some such instruments used to exert controls over parking spaces which would otherwise attract and generate potentially unlimited demand can involve time or revenue restrictions, including tariffs and permits (Cost, 2006).

Albeit, on-street parking may be more difficult to control due to complexities around traffic management and enforcement.

Categorising car parking occurs in multiple ways. For example, it can be grouped by the parking space's *ownership, position* or by the *type of users* it attracts (Enoch, 2014). These parking spaces can be 'publicly operated', 'private non-residential owned,' 'on/off-street,' or 'commuters.' Equally, car parking can be branded by the user's *origin* or *destination* (Palmer and Ferris, 2010), these being 'residential' or 'visitor', amongst others. Subject to numerous classification nuances render parking less than standardised, and thus more arduous than it might appear to casual observers who may only see a car parked in a space.

2.2 Parking Capacity

This section draws together a collection of literature which has identified a common cause of frustration, particularly among individual users, which is the apparent undersupply of car parking provision. Focusing on more direct car parking issues of parking capacity these stem from a mismatch in supply and demand (Beetham, 2015). Firstly, there is an *undersupply* at particular times in particular locations, which means that individual users struggle to find a space to park in. Congestion is exacerbated and accessibility to Central Business Districts (CBDs) is negatively impacted. Secondly, in cases where there is an *oversupply*, there are issues of land take, contribution to urban sprawl and the provision of free car parking.

An undersupply can lead to in users driving about searching for a space to park in, which can be not only frustrating, but also time consuming. As car parking forms a crucial part of the transport system (Litman, 2011), the issue of searching for an available car parking space it seems, is not a new one (Gomes, 1986). Yet it remains unresolved (Qian and Rajagop, 2013). Such persistence could infer that the challenge of finding an available space to park in is not a straightforward one to overcome.

One author with an interest in the phenomena of searching for a car parking space is Shoup Donald, who offers the cause, solution and the consequences if the solution is ignored. He postulates that;

Because the government sets curb parking prices, planners and elected officials strongly influence drivers' decisions to cruise. The failure to charge market rates for

curb parking congests traffic, pollutes the air, wastes fuel, and causes accidents…. Even a small search time per car can create a surprising amount of traffic…. Because this cruising adds to traffic that is already congested, it makes a bad situation even worse. (Shoup, 2006:479-480).

Shoup (2006) and his assistants conducted 160 park-and-visit tests by bicycle and found that the average search time for parking is 3.3 minutes for all times, but is nearly 10 minutes during evening hours. The average search time of 3.3 minutes may seem insignificant, but added up across all of Westwood's drivers; it amounts to 426 hours per day (a little more than 10 work weeks). Dowling et al. (2017) reporting the studies done by Shoup Donald assert that a majority of drivers spend anywhere between 3.5 to 14 minutes in a typical search. These times quickly add up to cause significant productivity losses in cities.

Ogunbodede et al. (2008) noted that the supply of infrastructures has often not been able to keep up with the growth of mobility. Increased motorization has expanded the demand for parking space; hence motorists spend precious time looking for parking spaces. This situation has created space consumption problems, particularly in central areas. On average, infrastructure provision has not been able to keep up with the growth in the number of vehicles.

Central business districts (CBDs) also appear to be a key issue in the car parking literature as they appear to be the location type affected by undersupply. Car parking inside a CBD is an issue that has continued to develop. For instance, Ligocki and Zonn (1984:350), describe the car parking situation in a CBD as "a problem eventually faced by most participants in central business area activities. Moreover, parking covers more surface area than most other land uses in the CBDs of United State cities". He is affirming that the size and scale of the problem are significant. This is because people visit the CBD for various reasons such as; business, employment, shopping, recreation and others (Osoba, 2012).

According to Obot et al. (2009), in situations of lack of provision and poor planning in respect to other urban land use activities, the economic activities of the city may be affected. Increase in numbers of vehicles without adequate infrastructure has accentuated the problems of traffic congestion, traffic delays, parking problems, accidents, and urban land use severance (Raji and Wasiri, 2008). The situation

(traffic situation) is worsened when parking facilities as a major element of urban transportation development are neglected in the face of increasing activities which generate enormous parking demand (Ogunbodede and Ogundare, 2014a).

Parking demands far outweigh the available supply in most Nigerian cities (Ogundare, 2013). This results in road-side and illegal parking, which are common features in urban centres of Nigeria. Oyedepo (2016) adds that Akure is a medium sized city in Nigeria where traffic congestion is one of the most noticeable problems inhibiting vehicular movement. This is because there are no designated parking spaces except the ones provided at the central and National Electric Power Authority (NEPA) markets, which has already proved inadequate. The main problem, therefore, is that the available parking capacity could not be provided for the peak demands and therefore waiting and delay times, which are products of traffic congestion, are inevitably prolonged.

Roadside and illegal parking are common phenomena in Addis Ababa, especially in the CBD due to the limited spaces for parking. The on-street parking narrows the road, thereby causing unnecessary congestion and accidents in the city (Kiunsi, 2011). Recent research organized by the Royal Automobile Club (RAC) Foundation (2004) found that 48 percent of respondents acknowledged that they were parked illegally.

In the study by Ogundare and Ogunbodede (2014b) on traffic congestion and parking difficulties in Akure metropolis, Nigeria, it was observed that the parking problem in the CBD of Akure is a major cause of traffic congestion. In studying Performance Analysis of Off-Street Parking around the CBD of Akure Southwest Nigeria, Oyedepo (2016) found that the parking spaces were inadequate as they operated above the maximum capacity.

Another issue, and probably the biggest barrier for Africa is a lack of public parking as has been observed to happen in major cities. This has been a key problem for many municipal governments in Africa as they undergo rapid motorization (Ferilli, 2008). Therefore, one of the major causes of parking scarcity identified by Shiferaw (2014) is the lack of parking supply. A recent survey conducted by Step and Mint Limited (2012) based in Nigeria reported that Cairo's public parking infrastructure could only accommodate 5.2 percent of its cars, Lagos 6.7 percent of its cars and

Johannesburg had a ratio of 8 cars per public parking space. Alarmingly, major cities in Africa are reportedly lacking parking spaces of up to 70 percent (Step and Mint Limited, 2012). According to parking estimates done by Step and Mint Limited (2012), most cities in Africa could lack up to one million parking spots by 2020. Based on the research, parking supply problems are twofold:-

Firstly, there is a general lack of parking spaces throughout African cities. Despite the rapid pace of construction in South Africa, Nigeria, and many more developing Africa countries, rising car consumption continuously outpaces it. The overall growth of cars by far exceeds parking infrastructure, particularly public parking.

Secondly, the parking spaces that are supplied in most African cities are not necessarily used as efficiently as they could. For example, in Nigeria, public parking spaces that are available often do not have time limits. This entails that a space in a high demand area for parking may be taken by some individuals for most of the working hours. This speaks to the need for putting into effect the fair use of space and fee collection issues.

The inadequacies of parking supply can therefore, be attributed to poor urban planning and encroachment on existing parking spaces. On the demand side, there has been a tremendous increase in the number of vehicles. This has created a high demand for parking spaces. As parking supply falls and parking demand rises, the degree of parking deficiency increases.

2.3 Parking Characteristics

Parking is a necessary component of motor vehicle travels. Travellers usually attach great importance to the conditions of parking (Clinch and Kelly, 2004). Variations in parking features can influence individuals' choices of parking location or travel modes (Thompson and Richardson, 1996).

In practice, parking choice is a complex process and is influenced by many factors. It has been asserted by Thompson and Richardson (1996) that parking choice behaviour could be considered as a search-process in which parking users make a series of relative decisions based on their own experience and the conditions provided by a specific parking place. When a motorist is deciding whether or not to park at the usual parking place, he/she will firstly evaluate the conditions of the car

park. During this time, the user will put into consideration a number of factors before making a decision; travel time to parking places, availability of parking spaces, ease of entering or exiting the parking lot, walking time to destination, the distance to pay machines, and pricing. Meanwhile, motorist's characteristics such as gender, age and travelling group, etc. will also have an impact on parking choice (Young, 1986; Waerden, et al. 2003). Dissatisfied parking users will try to find another parking place and restart the above evaluation process (Thompson and Richardson, 1996). Or, they might choose to use an alternative mode. Other users who are satisfied with the overall condition of the parking space after trade-off will choose to park there.

Diallo et al (2012) report that parking users are affected by factors such as price and walking distance to the final destination in their choice for parking. Weant and Levinson (1990) argue that walking distance is competing with the cost of parking. Habib et al (2012) investigated the relationship between parking choice and activity-travel scheduling behaviour using the 2008 Origin Destination survey data from Montreal. They showed that activity scheduling decisions of car drivers are significantly influenced by parking choice (being reflected in parking type and space availability). Several authors such as Bergman (1991), Diallo et al. (2012), and Coates (1997) focused on the less tangible areas of the parking problem that influence parking choice. These range from the perception of safety or comfort by the users of parking spaces, on the impacts of laws, regulations and parking policies in the communities. Shoup (1999) supports that for users of the parking spaces, the perception of the comfort of the sidewalk, between the parking area and the final destination increases the tolerated walking distance.

According to Dowling et al. (2017), searching for parking presents a challenging task in urban districts around the world. Drivers in dense urban areas frequently find that desirable parking close to their destination is unavailable or prohibitively expensive. As a result, the act of cruising for parking can arise from any number of situations: desirable parking near a destination being at capacity, price differences between public curb side parking and private garage parking, or simply a driver's lack of familiarity with their surroundings.

2.4 Traffic Volume Studies

A traffic study is conducted to evaluate the transportation system serving an area and to identify any improvements necessary to accommodate existing or projected traffic volumes. The purposes of carrying out traffic volume count are; designing, improving traffic system, planning, management etc., and for providing better means for the development of infrastructures such as Parking facilities. Therefore, traffic volume/flow is the total number of vehicles that pass over a given point or section of a lane or roadway during a given time interval. It is the actual number of vehicles observed or predicted to pass a point during a given interval (Traffic Volume Study Report, 2013).

Robertson (1994) explains that two methods are available for conducting traffic volume counts: (1) manual, and (2) automatic. Manual counts are typically used to gather data for determination of vehicle classification, turning movements, the direction of travel, pedestrian movements, or vehicle occupancy. Automatic counts are typically used to gather data for determination of vehicle hourly patterns, daily or seasonal variations and growth trends, or annual traffic estimates. The selection of study method should be determined using the count period. The count period should be representative of the time of day, the day of the month, and month of the year for the study area. For example, counts at a summer resort would not be taken in January. The count period should avoid special event or compromising weather conditions (Sharma, 1994).

Count periods may range from Five minutes to One year. Typical count periods are 15 minutes or Two hours for peak periods, Four hours for morning and afternoon peaks, Six hours for the morning, midday, and afternoon peaks, and 12 hours for daytime periods (Robertson 1994). For example, if you were conducting a Two-hour peak period count, eight 15-minute counts would be required. Manual counts are typically used for periods of less than a day. Normal intervals for a manual count are Five, 10, or 15 minutes. Traffic counts during a Monday morning rush hour and a Friday evening rush hour may show exceptionally high volumes and are not normally used in the analysis. Therefore, counts are usually conducted on a Tuesday, Wednesday, or Thursday (Robertson 1994).

Generally, when traffic studies are done, manual counts of turning movements are undertaken from 6:00 to 9:00, 10:00 or 11:00 to 14:00, and 15:00 and 18:00. These are the most suitable periods to obtain the morning peak, off peak and evening peak volumes (Sampson, 2016). The day/week chosen should be one with no public holiday and not on the month end as they would influence the volume of the traffic.

2.4.1 Frequency of Traffic Counts

According to the Roads Department of Botswana (2004), in order to predict traffic flow volumes that can be expected on the road network during specific periods, cognisance should be taken of the fact that traffic volumes change considerably at each point in time. There are three cyclical variations that are of particular interest:

- Hourly pattern: The way traffic flow characteristics vary throughout the day and night;
- Daily Pattern: The day-to-day variation throughout the week; and
- Monthly and yearly Pattern**:** The season-to-season variation throughout the year.

When analysing the traffic, one must also be aware of the directional distribution of traffic and the manner in which its composition varies.

Hourly patterns

Typical hourly patterns of traffic flow, particularly in urban areas, generally show a number of distinguishable peaks. Peak in the morning followed by a lean flow until another peak in the middle of the afternoon, after which there may be a new peak in the late evening. The peak in the morning is often more sharp by reaching the peak over a short duration and immediately dropping to its lowest point. The afternoon peak, on the other hand, is characterised by a generally wider peak. The peak is reached and dispersed over a longer period than the morning peak. However, in urban satellite towns, the morning peak may be too early and evening peak may be too late in comparison to the principal towns without significant midday peak (Roads Department of Botswana, 2004).

Daily patterns

The traffic volume generally varies throughout the week. The traffic during the working days (Monday to Friday) may not vary substantially, but the traffic volume during the weekend is likely to differ from the working days on different types of roads and in different directions. In Botswana, many of the urban population go to the rural areas during the weekends. This causes a high variation of traffic on the urban- rural connector roads during weekdays and weekends (Roads Department of Botswana, 2004).

The pattern from Monday to Friday is often relatively consistent, apart from Monday morning and Friday afternoon traffic flow. The pattern during the weekend may vary considerably. The pattern also varies from Saturdays to Sundays. The pattern during the weekends is also likely to show more seasonal variation than during the working days (Roads Department of Botswana, 2004).

2.4.1 Case Studies of Traffic Volume Studies

Osoba (2012) argues that the traffic volume measured in Passenger Car Unit (PCU) in Allen business area is higher during the peak period with an average of 1,320 obtained against 1,048 P.C.U. for the off-peak period. The peak hour's traffic flow indicates that the traffic intensity is high in the early morning when the journey to work, school, and business are undertaken while the evening peak period shows that most people are returning home.

Adigun (2013) did a traffic count study on a section of Ikorodu-Sagamu Road located in the northern part of Ikorodu. It is within the Ikorodu North Local Government Area of Lagos State in Nigeria. A total of 29008, 24637, 22072, 18796, 22517, 15505 and 10246 were recorded for Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday respectively. Also, average vehicles per hour for these days were found to be 2417, 2053, 1839, 1566, 1876, 1292 and 854 respectively. The traffic pattern showed a general characteristic of high volume in the morning from 7.00 am to 11.00 am. Thereafter, the traffic volume dropped during the mid-afternoon from 11.00 am to 3.00 pm. The traffic volume surged upward again in the evening from 3.00 pm to 7.00 pm.

It was also noted that unlike other working days, the traffic volume on Thursday was lower in volume and devoid of the early morning high volume which characterize other working days. Traffic during the weekend shows a reduction in traffic volume. Saturday traffic in addition to its lower volume has a similar trend with Thursday traffic pattern. The traffic count also revealed that Sunday had the least traffic volume with a value less than half of most of the working days. The vehicular traffic flow along the road was high on each working day with a peak period in the mornings. This could be attributed to people going to work outside Ikorodu which is a substantially residential area in nature. Another contributing factor to this could be people travelling out of Ikorodu. In the afternoon, people are still at work, hence, the reduction in traffic volume during this period. In the evening, the traffic volume increased again because people have closed from work and are returning back.

2.5 Parking Legislation and Regulations

Parking regulations are designed to stop vehicles from parking where it would be dangerous or inconvenient for others. Parking regulations are in place to ensure safety and fairness for local pedestrians, drivers, home and business owners. Parking regulations control who, when and how long vehicles may park at a particular location, in order to prioritize parking facility use (Litman, 2016). However, Brooke (2015) contends that regulating parking is about illegal parking control and enforcement. His argument is that the control and enforcement of illegal parking entail the imposition of fines on motorists who have parked in opposition to stated regulations in a particular locality. For example, overstaying a set parking duration, occupying more than one marked bay, parking in areas where parking is not permitted, or not paying a required fee. Legislations are used to regulate parking and differ from one country or city to the other.

2.5.1 Parking Legislation: A Case of England (According to Butcher, 2016)

The general principle is that it is legal to park at the side of the road (on street parking), except where there are local authority restrictions in place. Driving onto the pavement to park is illegal. But there is an issue about how widely this is enforced as it is a criminal offence (i.e. enforced by the police) rather than a civil offence (enforced by the local authority). Almost all other parking offences are now civil

ones. There is separate legislation banning pavement parking in London and more widely for heavy commercial vehicles. Some on-street and pavement parking will be seen as causing an obstruction and can be dealt with by the police or traffic wardens. However, most enforcement is by local authorities who have assumed control for decriminalised/civil parking enforcement under Part 6 of the *Traffic Management Act 2004*. As part of this process, they can designate 'Special Parking Areas' (SPAs) in which vehicles parked on street or on the pavement can be ticketed for contravening parking regulations (e.g. parking on a yellow line), rather than for causing an obstruction.

Pavement parking is banned in London, under section 15 of the *Greater London Council (General Powers) Act 1974*, as amended and it is defined as parking a vehicle so that "one or more of its wheels" is resting on a pavement. Goods vehicles with an operating weight exceeding 7.5 tonnes are prohibited from parking on verges, footpaths or the central reservations of roads under section 19 of the *Road Traffic Act 1988*, as amended. Although parking is generally permitted at the side of the road, except where there are restrictions or a specific offence has been committed, driving actually onto the pavement or footway (to park or otherwise) is an offence under section 72 of the *Highways Act 1835* (see also section 28 of the *Town Police Clauses Act 1847* under 'obstruction',).

Local authorities and the police have the power to remove a vehicle if it is illegally parked, causing an obstruction or has been abandoned. The power to remove vehicles is given to the police by sections 99-102 of the *Road Traffic Regulation Act 1984*, as amended, and by the *Removal and Disposal of Vehicles Regulations 1986 (SI 1986/183)*, as amended, made under sections 99 and 101 of the 1984 Act. The powers of removal under section 99 include vehicles which are parked illegally, have broken down and those which cause obstruction, danger or potential danger. If therefore it can be shown that a vehicle is illegally parked, causing an obstruction or is abandoned, the local authority and the police may remove it under this legislation. It should be pointed out, however, that they do not have to remove a vehicle in any of these three cases, merely that they may do so.

A highway authority can ban parking in a specific area by way of a Traffic Regulation Order (TRO) made under Parts I and IV of the *Road Traffic Regulation*

Act 1984, as amended. Section 2 of the 1984 Act sets out what TROs may be used for and it includes almost anything prohibiting, restricting or regulating the use of a road by traffic or pedestrians, including parking. There are three types of TRO: permanent, experimental and temporary. While permanent TROs require a lengthy consultation process, experimental orders, as precursors to permanent orders, can be implemented more easily and quickly.

Part 2 of the British Clean Neighbourhoods and Environment Act 2005 introduced two new offences:

- To prevent individuals parking vehicles on the street in order to sell them; and
- To prevent individuals parking vehicles on the street in order to carry out repairs in the course of a business.

Under Section 3, it is an offence for a person to park motor vehicles on a street, where the vehicles are parked merely in order to be sold. There must be two or more vehicles on the same street, no more than 500 metres apart, for the offence to be committed. The provision is not aimed at an individual selling a car privately; he has to be acting as part of a business. Under section 4, it is an offence to carry out 'restricted works' to vehicles on a road. Again, it does not apply to someone who can show he was not repairing the vehicle in the course of a business although this is so only as long as it does not cause annoyance to persons in the area. A second exception is where the repairs arose from a breakdown or accident and are carried out promptly.

There has since been a renewed push to reintroduce a nationwide 'blanket ban'. This has been led by charities such as Guide Dogs for the Blind and Living Streets and has garnered widespread support. They argue that:

> *Pavement parking affects people across the country. For many people including those who have sight loss, parents with babies or toddlers in buggies, and wheelchair users — this is a serious problem. For someone who is blind, having to step off the pavement into the road because of a badly parked car can be extremely frightening* (Butcher, 2016:12).

2.5.2 Parking Legislation: A Case of Polokwane Municipality

Under the provisions of Section 156 of the Constitution of the Republic of South Africa, 1996 and the National Road Traffic Act, 1996 (Act 93 of 1996) Polokwane Municipality enacted the parking by-law with the following provisions (Polokwane Local Municipality, 2018):

The By-law under Section 1 (2) empowers the Municipality to manage parking and collect any fees related to parking or appoint a service provider to manage parking and to collect any fees related to parking. In Section 6 (1) No person who operates or who is in charge of a vehicle on a public road may park the vehicle in any public road within the municipal area for a period beyond that indicated on a road traffic sing relevant to the specific area.

Further the law in Section 8 (1) states no dealer or seller of a vehicle may park or allow to be parked on the verge of a public road within the municipal area a vehicle which is advertised for sale or for rental. It continues in Section 9 (1) that no person responsible for the control of a business of recovering or repairing vehicles may park, cause or permit to be parked, in any public road or public place within the municipal area any vehicle that is in an obvious state of disrepair, which has been placed in his or her charge in the course of the business of recovering and repairing.

Section 21 (1) provides for various methods of parking and restrict motorists to park (a) in a parking bay across a painted line marking the bay or in such a position that the vehicle is not entirely within the area demarcated as a parking bay; (b) in a parking bay which is already occupied by another vehicle; or (c) in a parking bay in contravention of a road traffic sign which prohibits the parking or stopping of vehicles in the public road or portion of the public road concerned. It also prohibits washing or cleaning of a vehicle in a parking ground or a parking bay under Section 41.

Under Section 29 the Municipality is not liable for the loss of or damage howsoever caused, to any vehicle or persons or any accessories or contents of a vehicle which has been parked in a parking ground or designated parking bay.

In addition Section 32 (1) states that a motorists in a parking ground or parking bay must observe and comply with any traffic or other sign, notice or surface marking which is placed or displayed for the purpose of directing and regulating vehicles

using the parking ground or the entrance or the exit to the parking ground or the parking bay and entering into and exiting the parking bay.

The Polokwane Municipality parking by-law also provides for establishing special parking places for use by taxis or the parking of a taxi belonging to a person to whom a permit to use the parking place has been given in Section 49 (1).

2.5.3 Overview of Parking Policy

In order to improve the built environment and solve problems resulting from the growth of car use and related parking; traffic planners in central governments, municipalities and consultancy agencies develop parking policy (Crow, 2012). Weterings (2013) adds that a parking policy consists of legislation, rules, and strategies to manage the mobility of the urban environment. The Institute for Transportation Engineers (lTE) (1985) concludes that the parking policy as a regulating tool for the use of cars in urban areas plays a vital role in defining urban planning and transport policy. By setting appropriate standards for parking requirements, the urban transport and land use systems are supported. The amount of parking supplied influences such systems and even the characteristics of the market.

The development of parking policy can be described in various ways according to how it addresses parking problems. Therefore, the following section highlights some parking problems a parking policy tackles;

i. Time Restrictions

Time restrictions are a common policy measure where the periods during which stopping, standing, or parking are limited. These policies are typically in effect during peak traffic periods and apply to passenger vehicles and commercial vehicles alike. In Toronto, common time restrictions are in effect between 7:30–9:30 am and 3:30–6:30 am. These hours have recently been extended as part of the city's Congestion Management Strategy (City of Toronto, 2014).

Other cities are using time restrictions that apply only to commercial vehicles. In Manhattan, the New York City Department of Transportation (NYCDOT) planned to implement delivery windows to designate curbside parking for freight vehicles in the morning and create better parking opportunities for passenger vehicles later in the day. They have learned that 65 percent of all deliveries occur before 12:00 PM and

granting exclusive parking access to freight vehicles during these hours can reduce traffic congestion. A similar strategy is used in Philadelphia where local businesses are encouraged to schedule the bulk of their deliveries before 10:00 am (Zalewski et al., 2011). Dijk and Montalvo (2011) add that time restrictions result in the more efficient use of available space from an increased turnover of cars.

ii. Pricing Strategies

Pricing strategies, in general, can encourage greater turnover of both passenger and freight vehicles to create better parking opportunities for newly arriving vehicles. The District Department of Transportation (DDOT) in Washington, D.C. has installed loading zone meters along K Street in response to all-day parking of commercial vehicles. The meters charge commercial vehicles $1 per hour and allow a limit of two hours for parking. The NYCDOT has also implemented a pricing strategy using the Muni-meter programme that uses an escalating rate structure of $2 for one hour, $5 for two hours, and $9 for three hours (NYCDOT, 2004). This strategy has led to considerable reductions of dwell times (from 160 minutes to 45 minutes) and highlights the impact of different hourly pricing combinations (Zalewski et al., 2011).

iii. Enforcement

Parking enforcement responds to a lack of regard for parking regulations. For example, the Los Angeles Department of Transportation (LADOT) has initiated an enhanced parking enforcement programme called “Tiger Teams” (FHWA, 2009). The programme deploys fifteen additional uniformed traffic control officials and ten additional tow trucks to enforce parking violations during peak hours.

Brooke (2015) augments that parking enforcement in some areas of the UK involves clamping or towing-away of vehicles, for which drivers must pay to later release or retrieve a vehicle. Parking control represents an additional cost for motorists; therefore, the likelihood of enforcement of illegal parking is an influencing factor in parking choice. The effect of wheel-clamping on parking search time was investigated in central London by May and Turvey (1984) who found that the number of vacant on-street meter spaces increased and parking search time decreased; indicating that enforcement increased parking availability and reduced search time for on-street parking spaces.

The lack of enforcement of the parking law in Beijing has proved itself to be a major issue as it perpetuates the parking problem. Vincent Au mentions in his article *Car Parking in China – Issues and Solutions*, states that too many government departments are in charge of parking related matters. These are Commission of Transport, Traffic Police, Traffic Management Bureau, Urban Management Bureau, Municipal Bureau, Street Office, Industrial and Commerce Bureau, and Price Bureau (Au, 2012).

iv. Parking Information Systems

This can also be referred to as the Parking guidance information system (PGI). It aims "to provide information to drivers concerning the location of, direction to and availability of parking spaces, and to thereby encourage a more efficient use of the parking stock and reduce the amount of parking search traffic within an urban area," (Polak et al. 1989:2). A further objective is to reduce parking search time and the associated local traffic congestion arising from vehicles circulating city centers in an attempt to find available parking spaces (Polak et al., 1989). Various major metropolitan cities have recently incorporated innovative technologies to better manage the available scarce curb space.

San Francisco Municipal Transportation Agency (SFMTA) has initiated one of the most comprehensive parking programs called SF*park*. SF*park* collects and distributes real-time information on the availability of parking spaces on a spot-by-spot basis. This information is collected using embedded parking sensors and distributed via a smartphone application. By providing this information, SFMTA hopes to reduce cruising for parking by directing vehicles directly to available spots.

Regarding the impact of laws and regulations, most studies argue for a greater tightening of laws governing parking (Diallo et al, 2012). Marsden (2006) conducted a literature review whose results contradict the theory that fewer parking spaces in business centres and retail areas contribute to their impoverishment. Shoup (2005) argues that subsidy policies and free parking lead to increases in the costs of goods and services, shared by all citizens, including those who do not use cars.

Oyedepo (2016) adds that the ineffective regulation on parking has further worsened the situation of congestion in most Nigerian cities. However, inadequate or improper

management of parking spaces, as well as ineffective law enforcement has compelled many to park along the road including the public transport operators.

2.6 Theoretical Underpinning

Urban Car Parking Model

Policies that govern the provision and operation of parking facilities are recognised to have an important bearing on the operation of urban transport system; decisions have often been made on an ad hoc basis, without proper integration with other elements of transport system analysis. Therefore, the Urban Car Parking Model is founded on the ground that, parking policy decisions to be well founded, the analysis of parking behaviour and the effects of parking policies should be fully integrated with other elements of the transport planning and modelling processing (Young et al, 1991).

When a motorist is deciding whether or not to park at the usual parking place, he/she will firstly evaluate the conditions of the car park. In this period, many factors can influence a parking user's decision. These include travel time to parking places, availability of parking spaces, ease of entering or exiting the parking lot, walking time to destination, the distance to pay machines, pricing, search time, security, travel purpose etc. (Teknomo and Hokao, 1997). The model looks at how motorists make a choice to park their vehicle in certain location and not the other.

This model is of significant importance both at the local and strategic level of planning. Parking policy and supply play a major role in traffic management systems in dense urban areas (Osoba, 2012). The amount and the location of parking affect, in particular, the level of service and congestion on access roads. Parking behaviour is characterized by the complex dynamic relationship between multi-dimensional demands, performance and supply quantities. The most commonly used parking models related to parking demand for the scale of a single land use were proposed by the Institute for Transportation Engineers (1985). The general approach has been extended (Le and Young, 1987) to take into account mixed land uses. Balijepalli et al (2008) postulate that that the parking behaviour of drivers is significant in modelling parking demand management. The distinguishing features of the models that should be used to investigate parking policy are that they should accurately represent these relationships. Balijepalli et al. (2008) specified a joint model for parking location and

traffic assignment using an equilibrium approach. The choice of parking is assumed to depend on the travel time between origin and destination, search time in the car park, parking charge, and distance to the final destination. Search time depends on the net flow into the car park and the capacity of the car park. Therefore, this study will focus on the Traffic Assignment Model in dealing with the parking problem.

Traffic Assignment Models

This model assigns vehicles to the traffic and parking network given an original destination matrix. Austin (1973) presented two processes for the allocation of parkers to parking stations in the CBD. Firstly, he used the trip generating model to determine the number of trips destined to particular zones in the CBD. Parkers were then allocated to parking stations depending on the cost of parking and walking distance. The allocation of trips was in proportion to the composition cost associated with each origin and parking lot destination pair.

The Gur- Beimbourn model was part of a larger system used to analyse the impact of integrated transport systems management strategies in city centres. Included in the procedures were calculations of parking impedance for each parking location in the area, including illegal parking. The model included the amount of time spent looking for a parking space as an increasing function of the utilization level of the parking area. With this relationship, it was possible to describe and analyse the parking process within the framework or user-optimized equilibrium assignment (Gur and Beimbourn, 1984).

In this model, parking has been considered as a daily system. Arrival rate patterns vary throughout the day. Gur and Beimbourn (1984) describe the application of the model to a high-density section of Haifa, Israel. In the test case, the sensitivity of parking behaviour was examined as it varied with the value of walk time, parking cost, parking fines, enforcement policies and level of travel demand.

Traffic Flow Theory

Wattleworth (1976) contends that there has been much significant development in the traffic flow theory. Some of these developments have led to very useful relationships while some applications have not been all that useful. He further said that probably, the most useful result of traffic flow theory is the development of the relationship

among the macroscopic variables of traffic stream flow (volume, mean speed and density) (Wattleworth, 1976; Hoogendoorn, 2007). Traffic Engineering uses the flow theory for the development of the level of services concept. However, there has been some criticism of the traffic flow theory work regarding the lag between the theoretical development and the application of some portion of the flow theory work. The traffic flow theories have largely looked into the basic relationship (why things happen). The fundamental characteristics of the traffic stream flow are Flow, Speed, and Density. Wattleworth (1976) defined flow/rate (q) as the rate at which vehicles pass a point on a roadway. It is expressed in vehicles per hour (veh/hr).

$$q = \frac{veh}{Hr}$$

Where: q is rate/flow, veh is Number of vehicles and Hr is the period of time taken to observe vehicles passing a point on a roadway

The volume (q) is also defined as the number of vehicles observed in a given time (Hr); volume is based on an actual count and expressed as vehicle, commonly converted directly to flow (q) which is a more useful parameter. For example, q = 5000, veh in 10min. = 30,000 vph.

This research, whose aim is to examine the problem of parking spaces in the Central Business District of Lusaka City, employed the use of the aforementioned models and theory in understanding the problem of parking facilities in Lusaka City CBD was important. The models helped to develop the best possible alternatives to improve parking facilities. The theory of Urban Car Parking Model and Traffic Assignment Model were used to understand the behaviour of parkers and identify the factors that influence the capacity of parking facilities, and the Traffic Flow Theory helped to carry out the traffic volume study for the CBD. Therefore, the integration of assessing the existing parking facilities, parking behavior, traffic volume studies and parking legislation and regulations will ensure that planners and Local Authorities clearly understand Lusaka CBD parking dilemmas and know that resolving a mismatch between parking supply and demand requires such an integration.

CHAPTER THREE
DESCRIPTION OF THE STUDY AREA

This chapter provides a description of Lusaka CBD as the study area of this research. This includes physical and socio-economic characteristics of the area, historical background and features in the study area.

3.1 Physical Characteristics

Lusaka is the capital city of Zambia, a country in the Central African Plateau with an average altitude of 1,000 to 1,400 m above sea level. The city covers an area of 375 km² of mostly flat relief. In addition to its capital city status, Lusaka's central location gives it strategic importance as it is easily accessible from all parts of the country.

3.2 Socio-economic Characteristics

Lusaka is the largest city of Zambia and one of the fastest-developing cities in Southern Africa. As of 2010, the city's population was about 1.7 million, with the largest urban population (CSO, 2014). Lusaka is the centre of both commerce and government in Zambia and connects to the country's four main highways heading north, south, east and west.

The CBD of modern society can be described as follows: It integrates a great deal of financial, business, culture and service institutions. It also has lots of supporting facilities, such as business office buildings, hotels, and apartments, etc., with perfect and convenient traffic, communications and other infrastructures, favourable economic development environment and places which are convenient for commercial activities. Among other things, corporation headquarters, financial centers, and specialized production service are three functional structures of the present Lusaka CBD. These also represent the most basic characteristics and connotation of the present CBD (Yaguanga 2011). The area considered in this study is the central grid plan section of Lusaka inner city, extending from Kabwe roundabout through Cairo Road to Kafue roundabout in the South, then Lumumba Road in the West, Ben Bella Road, and Kalambo Road in the South and North, respectively, as shown on Figure 3.1. The area under study is 729,254 m^2 in extent.

3.3 Historical Background of Lusaka CBD

Central Lusaka is the oldest part of the settlement and has been the major commercial area throughout the city's existence. The first store was established on the west side of Cairo Road, opposite the railway station in 1905. A cluster of retail outlets together with some residences developed in this area in the following two decades (Williams, 1986). It slowly inched forward from its beginnings as a rail siding trading post to become a regional administrative centre and service centre for a growing agriculture hinterland. By 1930, there was a relatively complete frontage of buildings, primarily shops, extending from Katunjila Road to Kalundwe Road as well as some less complex development at the rear of the blocks along Chachacha Road.

The trading area has continued to grow to extents where it has virtually encroached on the residential areas. What started as a single stretch along Cairo road later grew to include Chachacha Road, Freedom Way, and Lumumba Road. The existing CBD is located in the current city centre in the area near the intersection of Great North-Kafue road and Great East road, where the national railway and the central station are located. The centre is also within the vicinity of a new urban development that has commenced in the eastern part near the Lusaka City Airport operated by Zambia Air Force as an emergency airfield. On the other hand, areas between these two developments are observed to be changing gradually from large plot residential areas to commercial business land use (JICA, 2009).

3.4 Features in the Study Area

The study area included three major roads in the CBD, namely, Cairo road, Chachacha road and Freedom way. The study looked at parking problems on these roads with the view of coming up with solutions for these problems. The roads that were selected for this study are the core roads in the CBD, thus making the problem of parking a critical issue. Cairo road is about 1.6 km and connects the Kafue roundabout and Kabwe roundabout. It has three lanes going to the south and two lanes going to the north. It hosts the central bank of Zambia, as well as the biggest bank branches of Zanaco, Finance, and Barclays. It is also home to the National Milling company, shopping complexes, offices, service stations, and educational

facilities to mention a few. Chachacha road is a two lane road that only takes traffic from the northern end to the southern end of CBD. It consists of mostly hardware shops, boutiques, offices and two busy bus stations (Millennium and Lima tower bus stations). Freedom way is a dual carriageway with two lanes going in the North and two lanes going to the South. It is mostly consisted of electronic shops, wholesale and retail grocery shops, service stations, Lima tower bus station, post office etc. The mentioned landuses makes these roads attractive for both vehicular and pedestrian traffic which requires properly managed parking spaces. The location of CBD is as shown in Figure 3.1.

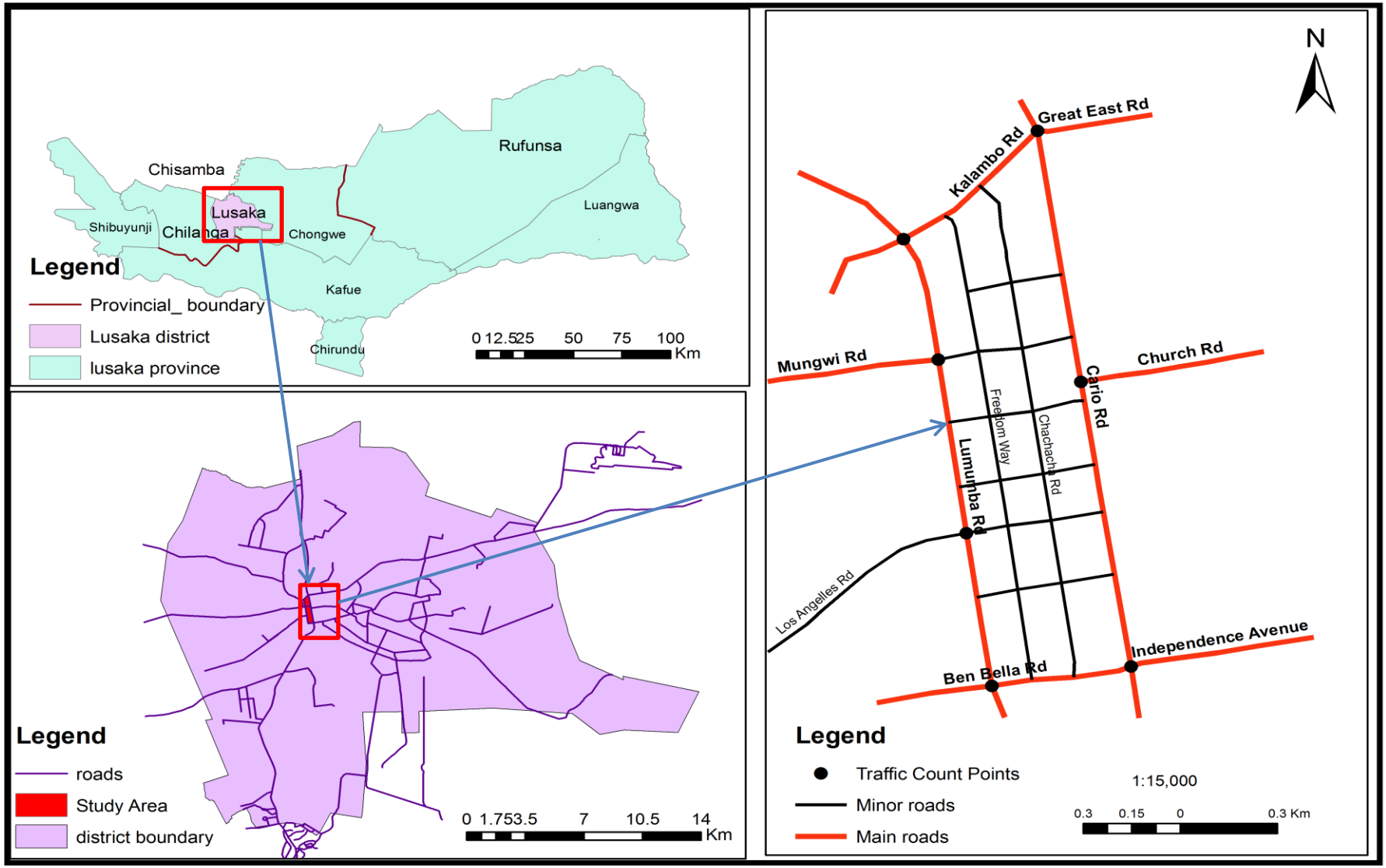


Figure 3.1: Location of Lusaka Central Business District
Source: Generated by the author from GIS data, 2017

CHAPTER FOUR
METHODOLOGY

This chapter highlights the methodology used in this research. The first part outlines the approach used in the study design of the research while the second section highlights the methods of data collection used. Part three discusses how the information was analyzed, and lastly outlines ethical considerations and limitations of the study.

4.1 Research design

A research design is a plan or strategy that moves from the underlying philosophical assumptions to specifying the selection of respondents, the data gathering technique to be used and the data analysis to be done (Maree, 2007). Taylor (2000) defines research designs as constructed plans and strategies that are developed to seek and discover answers to research questions. The case study approach was used in this study in order to thoroughly examine the problem of parking in Lusaka CBD. The important task of a case study is to understand the uniqueness and complexity of a single case (Simons, 2009; Abercrombie et al, 1984). The case study was appropriate for this study because it deals with the intricacy and precise nature of the case in question (Stake, 1995). It helped to understand the problem of parking in detail using a variety of methods to obtain in-depth knowledge (Collis and Hussey, 2009). This is because parking problems are regarded as real-world research problem and a contemporary phenomenon as currently experienced by motorists in Lusaka CBD.

4.2 Data collection

4.2.1 Primary Data

Interviews using an interview guide were used to collect data from the key informants from Lusaka City Council, Road Transport and Safety Agency (RTSA), Parkrite Zambia Limited and Parkrite Marshals. In order to obtain parking characteristics, a questionnaire was administered to motorists and parking attendants on Cairo Road, Chachacha Road and Freedom Way as these are the main roads in the CBD. Field observations using a still camera were used to collect primary data to validate the capacity of parking facilities in the CBD.

In order to ascertain the volume of traffic at different entry and exit locations to the CBD, different days of the week, different times of the day and different directions, a traffic volume study was done. It involved indirect manual counts where data was collected using a video camera which captures data for a longer period of time, stores it for later use and examination, and also allows rewinding for re-examination (Halder *et al*, 2013). The counts were done at seven entry and exit points to the CBD namely, Kabwe Roundabout, junction of Church and Cairo Roads, Kafue Roundabout, junctions of Ben Bella and Lumumba Roads, Los Angeles and Lumumba Roads, Mungwi and Lumumba Roads, and Kalambo and Lumumba Roads. This involved all seven days of the week and it was done from 11th to 17th September 2017. The week chosen was one with no public holiday and not on the month end as that would probably have influenced the volumes of traffic.

One-hour video coverage's were recorded for both peak and non-peak periods (weekday and weekend) at the seven locations. The times involved were 07:30 – 08:30, 12:30 – 13:30 and 15:30 – 16:30. This is because generally, when traffic studies are done, manual counts of turning movements are undertaken from 6:00 to 9:00, 10:00 or 11:00 to 14:00, and 15:00 and 18:00 (Sampson, 2016). This study confirms that these are the most suitable periods to obtain both peak and off peak volumes as it is important to know for both peak and off peak in order to plan for parking adequately. Therefore, for all the locations, days and times, traffic counts were done for both vehicles going in and out of the CBD. The vehicles counted were all those with the potential to park in the CBD except for public transport and heavy goods trucks.

4.2.2 Secondary Data

The research reviewed The Local Government Act No. 22 of 1991 Chapter 281 (GRZ, 1991), The Public Roads Act No. 12 of 2002, Chapter 261 (GRZ, 1992), The Road Traffic Act No. 11 of 2002, Chapter 105 (GRZ, 1992), The Urban and Regional Planning Act No. 3 of 2015, Chapter 23 (GRZ, 2015), Comprehensive Urban Development Plan for the City of Lusaka (JICA, 2009) and The Doxiadis Lusaka Development Plan (Doxiadis Limited, 1975). This was in view of establishing whether legislation that governs parking is adequate.

4.3 Sampling Methods

Purposive sampling was used to select the informants based on position and knowledge of the phenomena under study, these included Lusaka City Council, Road Transport and Safety Agency and Parkrite Zambia Limited. The study selected at least one (1) representative from each of these institutions, giving a total of three (3) interviewees. Convenient sampling was employed to select motorists. This is because motorists are mobile, and there is no record of which motorist goes into the CBD. Thus, it was not possible to draw a random sample since there was no knowledge of the population from which it could be drawn (Becker, 1963). A total of 60 questionnaires were administered to motorists until reaching a theoretical saturation which is simply defined as data satisfaction, a point where no new information is obtained from further data (Glaser and Strauss, 1967). Saturation point determines the sample size in qualitative research as it indicates that adequate data has been collected for a detailed analysis. However, there are no fixed sizes or standard tests that can be used to determine the required data for reaching saturation (Kendall, 2008).

Parking attendants were randomly selected using Bless and Achola's (1988) 'Rule of Thumb' requiring at least 5% of the population to be sampled. Because the population reasonably homogeneous and only a smaller sample were needed, this needed to be fewer than 50 for it to be manageable (Ritchie et al, 2003). Since parking attendants were 89 in total, therefore the sample was:

$89 \times {}^{5}/_{100} = 4.45$ number of respondents.

To obtain enhanced results, the study selected a total of 20 parking attendants.

4.4 Data analysis

The data were analysed as illustrated in Table 4.1.

Table 4.1: Data Analysis Methods

S/N	objective	Analysis
1	To assess the existing capacity of parking facilities in the CBD	Descriptive statistics (find existing parking spaces in the CBD, the mean time taken to find parking space, the

		mean time a car spends on a parking slot in different parking zones)
2	To examine the volume of traffic at different locations, days, times and directions for Lusaka CBD	ANOVA TEST was used in ascertaining whether there was a significant difference in the mean hourly traffic volumes in terms of: 1. Different entry and exit locations for Lusaka CBD 2. Different days of the week 3. Different times of the day 4. Vehicles going in and out of the CBD 5. Location, day, time, and direction do interact to affect the mean hourly traffic volumes (Using MINITAB 14.1 and 18.1. Inc., 2017)
3	To assess the adequacy of the current legislation for parking	Content Analysis (Local government Act, Public Roads Act, Road Traffic Act, The Urban and Regional Planning Act, 2015, Lusaka Urban Comprehensive Development Plan and the Doxiadis plan for Lusaka)

Source: Field data, 2017

4.5 Ethical Consideration

The study ensured that the consent of participants was obtained. Participants were informed about the purpose of the study and their role in the research process. Consent was also obtained from participants before interviews were concluded. Furthermore, during the research, the respondents were assured that the information they gave would be treated with utmost confidentiality, privacy and anonymity.

4.6 Limitations of the Study

One of the weaknesses of the study was the use of a case study method that is believed to be the inability to generalise findings (Babbie and Mouton, 2001). Flyvbjerg (2006) disagrees with this assertion by arguing that it is possible to generalise from a single case study. Stake (2008) argues, in agreement with Flyvbjerg (2006), that one method to uncover the general is to begin by looking at

the particular, that is, the case. While strengthening the case study, this large amount of work and detailed processes made the study demanding in terms of labour, finances and time.

In countering methodological limitations with respect to the use of the case study method, the utilisation of more than one method of data collection served to enhance the validity and reliability of the research (Babbie and Mouton, 2001).

The traffic volume study demanded more labour, finances and time, and traffic count machine that was difficult to acquire because they are very expensive and all departments that deal with traffic control did not have this machine. Therefore, to counter this limitation, the study was only limited to a small area, the Lusaka CBD; the traffic volume study was only done for a period of One Week and only Three times per Day; and video cameras were used to substitute traffic count machines that allowed for capturing of data and further reexamine it later.

CHAPTER FIVE
RESEARCH FINDINGS AND DISCUSSION

This chapter presents the findings and discussion from data collected from the Lusaka CBD during fieldwork. The primary data was used to assess the existing capacity of parking facilities in the CBD and to ascertain the volume of traffic at different locations, days, times and directions for Lusaka CBD against parking spaces. Secondary data was used to assess the adequacy of the governing legislation and regulations for parking as it applies to Lusaka CBD. The findings and discussion chapter is segmented into four sections. The first section presents on respondents' socio-economic characteristics. The second section provides on the parking capacity of the CBD. Further, the third section provides the findings and discussion regarding the number of vehicles that go in and out of the CBD at different locations, times of the day and days of the week. Lastly, the fourth section is on the legislations that guide parking in the city and the CBD in particular.

5.1 Socio-Economic Characteristics of the Respondents

The study involved a total of 60 interviews that were conducted and none of the questionnaires was spoilt. This represents a response rate of 100 percent on which the analysis of data is based.

For this study, it was important to determine the sex dynamics in the research site and the results showed that most of the respondents (80 percent) are males while the remaining 12 (20 percent) are females. These results suggest that there are more male drivers in the study site.

The findings further, showed that 12 percent of the respondents were above 45 years, 38 percent were between the ages of 36 and 45 years, and 48 percent were between the ages of 25 and 36 years. These results further showed that Two percent of the motorists involved in the study were below the age of 25 years. Therefore, the mean age of the respondents in the CBD was 36 years. Based on these findings, it would suggest that most motorists/drivers in the study site are not youths (above the age of 35 years, GRZ, 2015).

Apart from age, it was also important to understand the educational background of the people in the study site because graduates are willing to pay for parking than non-educated individuals (Anastasiadou et al, 2009). In terms of formal education, more than half (68 percent) of the motorists had acquired tertiary education, and 30 percent reported to have reached secondary education level. Motorists that had attained primary education and those who did not attain any formal education consisted of only Two percent. The results suggest that most respondents had attained some level of formal education and able to comply with parking regulations.

With regards to approximate monthly income of motorists, Figure 5.1 gives this illustration. The approximate mean monthly income of motorists in Lusaka CBD was found to be 5,933 ZMW. These results suggest that most people in the study site can afford to pay for a parking space in the CBD.

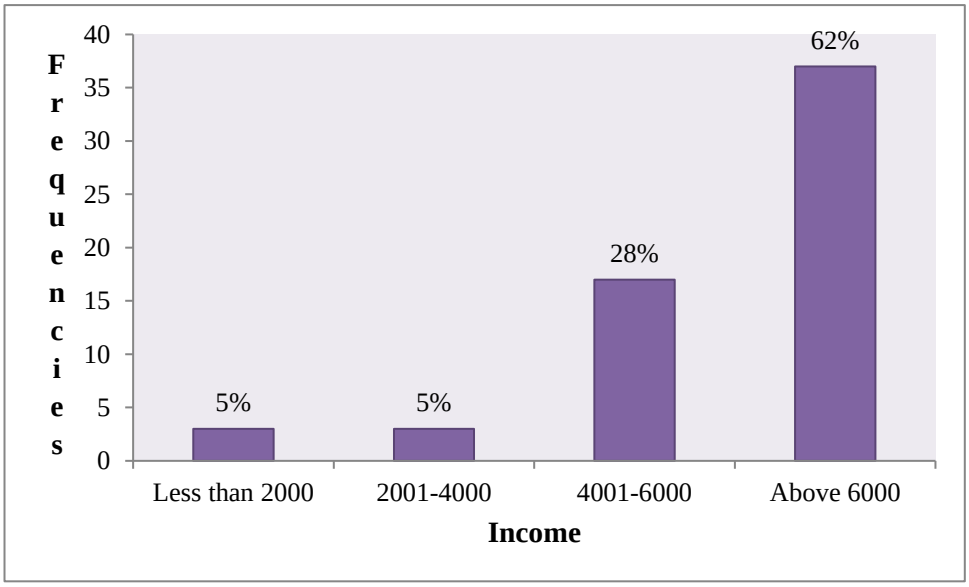


Figure 5.1: Approximate Monthly Incomes (ZMW) Of Motorists

Source: Field data, 2017

5.1.1 Implications of Socio-Economic Characteristics on Parking Demand

Socio-economic conditions can have a significant amount of influence on car ownership (Chaniotakis and Pel, 2015; Klein and Smart, 2017). This is because there is a vast difference in car ownership between developed and developing countries. Sobhani, et al (2017) argue that Socio-economic and demographic factors have a positive relation with various land uses regarding parking demand in developing cities. Identifying the impact of socio-economic and demographic factors on parking

demand can help to develop better parking legislations and provide a more accurate prediction of future demand. These factors include floor space, average household rent, population density, literacy rate (educational level), household density, growth rate, age, sex, and income levels which are identified as the most common socio-economic and demographic factors to describe the socio-economic condition of any city or country. For this study, only sex, age, educational background, and income levels of the people in the study site will be discussed.

Another demographic factor is age. It has an impact on parking demand and supply. Simićević et al (2012) argue that it is more likely that younger parking users would give up parking than the older ones. Hess (2001) and Takama and Preston (2008) also concluded that the younger population can be more easily influenced by parking measures, eventually affecting the demand for parking. The users under the age of 45 are more likely to change their behaviour as a response to an increase in the parking price than those over the age of 45. They opt for on-street parking, and for informal Park and Ride facilities.

In view of this, the results from the study show that most of the motorists in Lusaka CBD are not youths but are below the age of 45 years. This presents a problem because it suggests that illegal parking in Lusaka CBD is more likely to occur, especially when parking measures are introduced in the CBD such as pricing. This is because about 88 percent of the sampled motorists in the CBD are below the age of 45 years.

Literacy levels also show influence on parking demand. It seems rational because car ownership is related to financial condition and usually financial condition is closely related to literacy rate. It is reasonable because a person's economy likely influences the mode of transport and parking demand. The increase in parking demand in restaurants and shopping centres is affected by the increase in literacy rate. It may be logical as less literate people are more likely to go to a street market than a restaurant or shopping mall (Sobhani et al, 2017). Furthermore, Anastasiadou et al. (2009) postulates that highly educated people value time and are more willing to pay for parking charges. This study found that most motorists in Lusaka CBD had acquired tertiary education, meaning that complying with paying parking charges is expected to be high in the CBD.

This finding is in line with Sobhani et al (2017) view that employment and income are proportional to the literacy rate as well as availing car ownership. On the other hand, Tsakalidis, et al (2015) argue that inadequate drivers' education may lead to illegal parking phenomena in central urban areas. For the study area, this means that high levels of education would help motorists to understand parking regulations and eventually reduce the parking problem in the Lusaka CBD.

On the other hand, there is a consideration of income level as a socio-economic factor. Sobhani et al (2017) observed a difference in car ownership in different cities of developed and developing countries as the socio-economic factors in these countries varies largely. People tend to buy more cars when they have more money. Therefore, there may be a relationship between socio-economic factors and parking demand, with car ownership acting as a link between them. If you look at the information presented in Figure 5.1, this study found that most of the motorists in Lusaka CBD on average 5, 933 ZMW. These findings suggest that most people in the study site are able to pay for parking space.

5.2 Assessment of existing capacity of parking facilities in the CBD

This section assesses the existing capacity of parking facilities in Lusaka CBD. This section will start by taking an inventory of parking spaces and its various types and later focus on parking behaviours that influence parking capacity (demand and supply).

5.2.1 Parking Capacity

The study showed that Lusaka CBD parking spaces have increased from 1800 parking spaces in 2000 to 4598 parking in 2016, representing a 61 percent increase in parking slots. This means that the CBD can only manage to hold 4598 vehicles per specific period. The increase of parking slots in the CBD can be attributed to the engagement of Parkrite Zambia to manage parking lots. According to a key informant from the Lusaka City Council (LCC), the partnering of Lusaka City Council and Parkrite Zambia in the provision and management of parking slots in the CBD was done to improve service delivery.

However, this study has found that only 2800 parking spaces were functioning as parking spaces and 1798 did not work as parking spaces. The reasons for this are that the parking slots have been turned into bus stations and bus stops. This is the case on Freedom Way near Kulima Tower Bus Station where buses were found parked on parking spaces for a long time and they do not pay for parking. On the same road (Freedom Way), other parking spaces were found to be used as motor vehicle garages. This is where vehicles are brought for repairs and takes as much time as they can until they are worked on. Parking spaces on Chachacha Road were found to be used as trading places of vegetables, clothes (locally known as *salaula*) as well as cars. All these reduce the capacity of parking in the CBD as shown on Plate 5.1.

Further parking spaces are reduced during the rainy season because the drainages in the parking spaces are blocked and motorists are discouraged from parking in such areas and resort to park in illegal places.

5.2.2 Types of Parking Facilities

The study established that Lusaka City CBD has two types of parking facilities, namely, on-street, and off-street parking. This means that motorists have the freedom to choose where to park. However, the study established that off-street parking spaces only accounted for 9.7 percent of the 4598 parking spaces. Thus, on-street parking (90.3 percent) dominates the CBD which contributes more to the parking problem as it narrows the roads and causes traffic congestion in the city centre. In the study area, it was observed that on-street parking narrows roads.

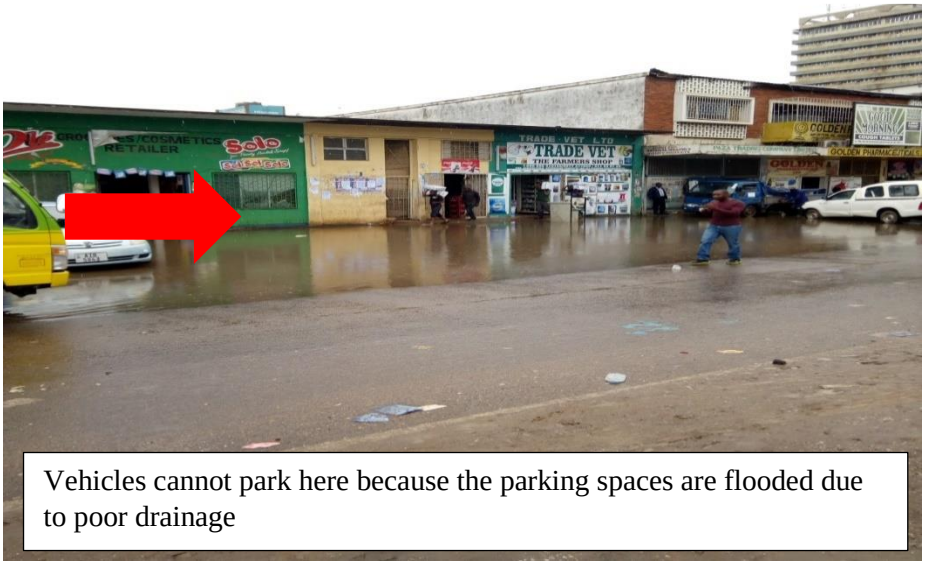
There are cases of double parking where two vehicles are parked on one space thus, causing the second vehicle to take up space on the road along the narrow roads thereby causing traffic congestion on all the three roads in the study area. These are the consequences of having very few off-street parking lots in the area. Furthermore, there are no parking bays or loading bays for transit vehicle such as taxis and buses for either picking up load or unloading goods and passengers along the routes. Consequently, drivers resort to haphazard parking which not only erodes the aesthetic values of the roadway and city structure, but also puts lives and property at risk.

Parking slots turned into Bus stations/stops (Freedom Way)

Parking slot turned into garage (Freedom Way)

Parking slots turned into trading place (Chachacha Road)

Parking slots turned into car dealing places (Chachacha Road)



Vehicles cannot park here because the parking spaces are flooded due to poor drainage

Plate 5.1: Reasons for Non-functional Parking Spaces

Source: Field data, 2017

5.2.3 Parking Prices

This study found that Parkrite Zambia offers five products to its clients and they have different parking charges. The first product is what they call Parking Payment and it's charged at 300 ZMW per month. With this product, a motorist will be given a disc which must be displayed on the windscreen for the parking marshals to see as one goes to park the car.

The second product is what is called the Reserve Bay. This is where the shop owner or an institution can reserve parking slots in front of their shop or building for their clients. This product is charged at 616 ZMW per month. In addition, the study showed that if a motorist was found parked on a reserved bay and did not go into the shop, the vehicle is clamped by the enforcement unit of Parkrite Zambia until a fee of 450 ZMW is paid. The third product is the Prepaid Parking Meter. This one can be bought at 300 ZMW and it comes with 120 units. This product allows the motorists to pay for the time only spent on the parking spot. The fourth product is the Casual On-street parking which is charged at 5 ZMW within an hour. Before Parkrite Zambia took over the management of parking in the CBD, Lusaka City Council used to charge 2 ZMW within an hour which is 16 ZMW per day for each slot. The coming of Parkrite Zambia increased this parking charge from 2 ZMW to 5 ZMW within an hour which is 40 ZMW per day for each slot, an increment of 60% on parking charges. The Loading and Offloading of Goods is the fifth product and it involves light and heavy trucks that are charged 54 ZMW and 75 ZMW, respectively per day. This translates to 10.8 ZMW and 15 ZMW per hour respectively for each slot.

The purpose of introducing these parking products as one key informant from Parkrite Zambia said, *"Was to give a variety of products to motorists from which to choose*." He further stated that *"the increase in parking fees was to discourage motorists from using private cars to come in the CBD."* This was done to increase the capacity of parking in the CBD.

However, in terms of willingness to pay for parking which was also assessed, it was revealed that 55 percent of the 20 parking marshals interviewed said motorists that park for longer hours especially for more than 2 hours are not willing to pay 5 ZMW

per hour. Only 25 percent of motorists are willing to pay and about 20 percent are only willing to pay part of the required amount as illustrated by Figure 5.2.

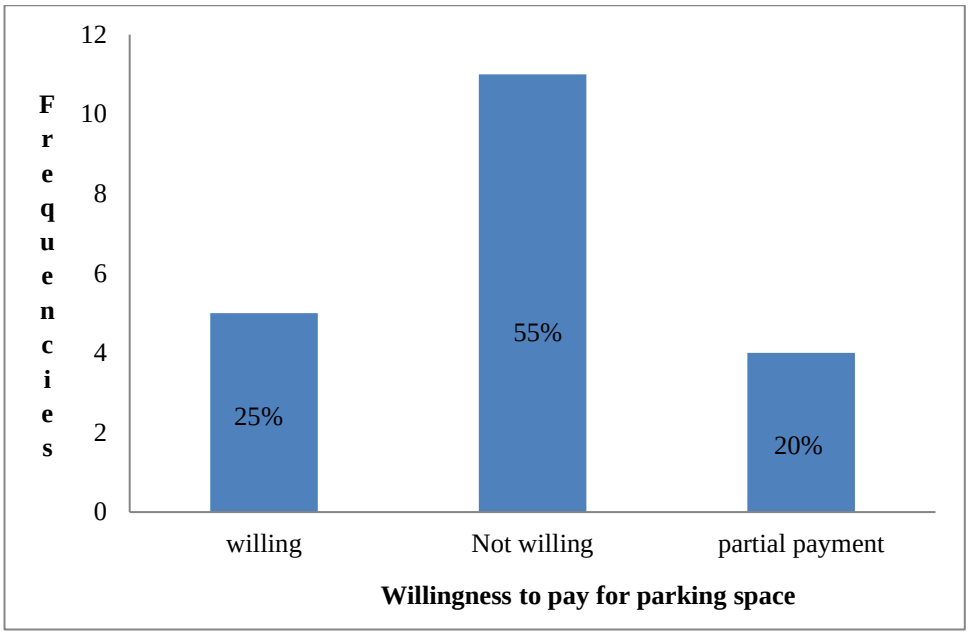


Figure 5.2: Willingness to Pay Parking Fees

Source: Field data, 2017

5.2.4 Parking Signs

The study revealed that 57 percent of the motorists thought there were no parking signs in the CBD and 43 percent thought there were parking signs in the CBD. Most of those that said there were parking signs in the area referred to only parking lines on a parking slot. However, parking signs go beyond mere parking lines. De Cerreno (2002) asserts that signs are the first line of communication with the public about on-street parking. Directional signs are important as they reduce the distance travelled by vehicles looking for a car park. It was observed that parking signs are not adequate in the CBD as they are limited to parking lines. There are no parking signs which show where to park and how to park. In addition, parking violation signs are not clear especially when one is driving as they have all been crowded on one board (Plate 5.2). Because of parking sign inadequacy, vehicles were found to be parked in areas that had no parking signs which made it hard to establish whether those areas were legal parking slots or not.

Plate 5.2: All Regulations on one Board

Source: Field Data, 2017

5.2.5 Implications of the Existing Parking Capacity

These results on assessing the parking capacity in Lusaka CBD echoes what Oduola (1981) said about urban congestion. According to him, most urban congestion problems are caused by the manner in which the roads are used. Yorgri, et al (2016) add that due to huge competition for land in the CBD where land values are high, construction and establishment of parking lots have always been a challenge. This has forced hawkers and venders to occupy the limited parking lots and on the shoulders of the roads. In the case of Lusaka CBD, parking spaces have been turned into trading places for marketeers, car dealers, taxis and motor vehicle mechanics. This inadvertently causes a reduction in the capacity of parking spaces in Lusaka CBD. The capacity of parking spaces is further affected by poor drainage facilities. This was similarly reported for Rawlings Park in Accra CBD where poor drainages lead to muddy parking spaces, thus discouraging motorists from parking.

These results further showed similarities with a study by Aderamo (2012) where it was observed that inadequate provision for off-street parking facilities results in

overuse of on-street parking. The results indicate that most of the parking spaces in Lusaka CBD are on-street parking spaces (90.3 percent). This reduces the effective width of roads leading to obstruction of traffic flow. Consequently, speed will be reduced, the journey time, and also the delay time will be increased. The operational cost of the vehicle increases, thus leading to a great economical loss to the motorists. According to a parking study on the existing traffic conditions on the road network in major urban centres, it is a requirement to remove on street parking system for efficient transportation system (Subramani, 2012).

One other aspect of parking capacity assessed was parking prices. The results show that on street parking prices were increased by 60 percent from 5 ZMW with the view of reducing private car use. This can be compared to the results from 107 United States cities on exploratory analysis suggesting that raising the cost of curb side and off-street CBD parking and parking violations may play a role in increasing public transit use in larger cities (Anchincloss et al, 2014). Ogut, (2015) adds that increasing of on-street car parking fee would make car users shift from on-street parking to usage of off-street car parking. He further argues that more than 50% of private car users would change from their mode of transport if on-street parking fees were increased.

However, the results in Lusaka CBD suggest that increasing parking fees has not improved the parking problem as they differ with the study that was done in Accra CBD where it was revealed that 89.3% of the respondents wish to pay for parking. However, 10.7% of respondents think that paying for parking is another way public officials or authorities use to siphon money from them, hence their unwillingness to pay (Yorgri et al, 2016). This can be attributed to what one motorist said that there was little awareness in the case of Lusaka CBD on the introduction of these parking fees. And quite simply, other motorists do not see the need to pay for parking. The bigger obstacles to charging for parking, as Shoup (2005) notes, are politics, and the resistance to increasing parking rates and putting a price on previously free parking. The results can also be likened to Hess and Polak (2004) study who observed that higher parking fee created more disutility than an expected fine for illegal parking; implying drivers were more likely to park illegally if parking fees were high.

Similarly, van der Waerden et al. (1993) found the probability of illegal parking decreased when likelihood of receiving a parking fine increased.

Parking signs are important in assessing the exact capacity of parking facilities. This is why it was important to assess the parking signs in the CBD of Lusaka city after assessing the parking prices. The results indicate that most motorists (57 percent) interviewed thought that they were no parking signs in the CBD. The implication of not having parking signs is that motorist end up parking illegally as observed in Lusaka CBD. Similarly, a study done in Nine (9) cities, namely, Boston, Chicago, New York, Denver, Washington D.C, Portland, San Francisco, Phoenix and Dallas on signage and communicating with the public revealed that there was dissatisfaction with signage. It was discovered that consumers often find signs confusing (especially where there are multiple regulations) or fail to see them. Thus, five of the nine cities made use of both pictures and words on the signs to make the message clear (De Cerreno, 2002). Having established that parking violation signs in Lusaka CBD are crowded on one board as observed on all the roads sampled, this means that haphazard parking will continue in the CBD and affect smooth flow of traffic.

5.2.6 Parking Behaviour

5.2.6.1 Trip Purpose

When it comes to the purpose of visiting the CBD, more than half (52 percent) of motorists reported visiting the CBD for business (Table 5.1) as the place is predominately commercial.

Table 5.1: Purpose of Motorists Visit to the CBD in Lusaka

Purpose	Frequency	Percent
Commuting	2	3.3
Business	31	51.7
Education	1	1.7
Work	17	28.3

Shopping	9	15.0
Total	60	100.0

Source: Field data, 2017

5.2.6.2 Motorists Description of Safety in Parking Lots

From the study, about 63.3 percent thought that parking lots in the CBD were fairly unsafe and very unsafe. Slightly over a quarter of the respondents (30 percent) thought that the parking lots were safe (Figure 5.3)

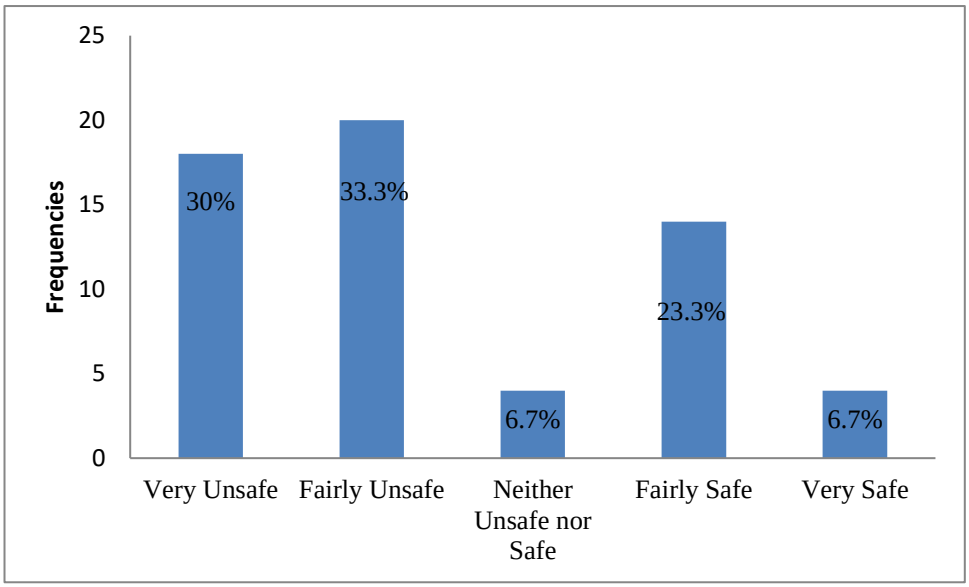


Figure 5.3: Motorists Description of Safety in Parking Lots

Source: Field data, 2017

Most of the interviewed motorists (63.3 percent) described safety in parking lots in the CBD as unsafe. This was attributed to the increase in the number of petty theft cases such as loss of side mirrors and other valuable items left in vehicles (i.e. laptops and wallets). Another reason for parking lot insecurity is the reduced number of police wardens engaged to patrol parking lots in the CBD. The police wardens are paid by Parkrite, which is reluctant to pay. Thus, only one or two officers are engaged to work on part-time the entire CBD and called upon when there is a need. The motorists that described parking lots as being fairly safe and very safe are those that park at organisations whose parking lots are reserved for their customers and they provide their own security. There is also no presence of call boys around such areas.

5.2.6.3 Estimated Time Spent Walking to Destination

In terms of estimated time spent walking to a destination, the results in Table 5.2, show that out of a total number of 60 motorists, 27 (45 percent) indicated that they spend less than a minute walking to their destination. It was found that on average, motorists spend about two minutes on Cairo Road and Freedom Way, and one and a half minutes on Chachacha Road walking to a destination. Therefore, the estimated time spent walking to a destination in the CBD was found to be two minutes and the standard deviation of 0.954.

Table 5.2: Time Spent by Motorists Walking to Destination

Time	Frequency	Percent
Less than 1 Min	27	45.0
01 - 05 Mins	19	31.7
06 - 10 Mins	11	18.3
11 - 15 Mins	2	3.3
16 - 20 Mins	1	1.7
Total	60	100.0

Source: Field data, 2017

The estimated time spent walking to the destination was affected by the choice of a parking slot. Most motorists (53 percent) parked near their destination and 45 percent of them spent less than a minute walking to their destination. This is because most of these motorists parked illegally near their destinations, thus reducing on time spent walking to a destination. It was further found that some motorists had parked elsewhere because there was a lack of parking space at their destination and some were avoiding traffic congestion. These accounted for 42 percent and percent, respectively. Only 13 percent walked between 6 – 10 minutes as they had parked elsewhere because there was a lack of parking space at their destination.

5.2.6.4 Estimated Time Spent Searching for a Parking Space

It was found that 63 percent of motorists took less than a minute, and between 1 minute and 5 minutes searching for a parking slot if they arrived between 07:00 and 09:00 hours in the CBD. Most motorists (79 percent) spent between 6-10 minutes searching for a parking slot if they arrived after 11:00 hours and 75 percent of the motorists that spent more than 10 minutes searching for a parking space arrived after 10:00 hours. This is as shown in Table 5.3.

Table 5.3: Cross Tabulation of Estimated Time Spent Searching for Parking Space and Different Arrival Time

		Time Spent Searching for Parking						Total
		Less than 1 Min	1-5 Mins	6-10 Mins	11-15 Mins	16-20 Mins	More than 20 Mins	
Time Parked	7:00-7:59	6	0	1	0	0	0	7
	8:00-8:59	4	2	1	0	1	0	8
	9:00-9:59	1	1	0	1	0	1	4
	10:00-10:59	1	4	1	1	0	1	8
	11:00-11:59	1	4	5	1	0	2	13
	12:00-12:59	1	4	1	0	0	0	6
	13:00-13:59	2	0	3	1	1	0	7
	14:00-14:59	0	3	2	1	0	1	7
Total		**16**	**18**	**14**	**5**	**2**	**5**	**60**
Percentage of respondents		**16/60**	**18/60**	**14/60**	**5/60**	**2/60**	**5/60**	**100**

Source: Field Data, 2017

Therefore, the mean time spent searching for a parking spot on the sampled roads was found to be as follows; Cairo Road was at two and half minutes, Chachacha Road was at two minutes and Freedom Way was at over three and half minutes. These results mean that on average, vehicles spent three minutes searching for a parking space in the CBD on all the three roads.

5.2.6.5 Estimated Time Spent on Parking Space

According to the study, it was found that 3,3 percent park for more than eight (8) hours and 23.3 percent of motorists park their vehicles for 8 hours. Figure 5.4 illustrates the time spent by motorists on a parking space. Conclusively, the average time a vehicle spent on a parking space according to the study was five hours thirty minutes, segmented as follows on the three roads sampled; on Cairo Road and Freedom Way vehicles spent fewer hours parked (five hours) compared to Chachacha Road (six and half hours).

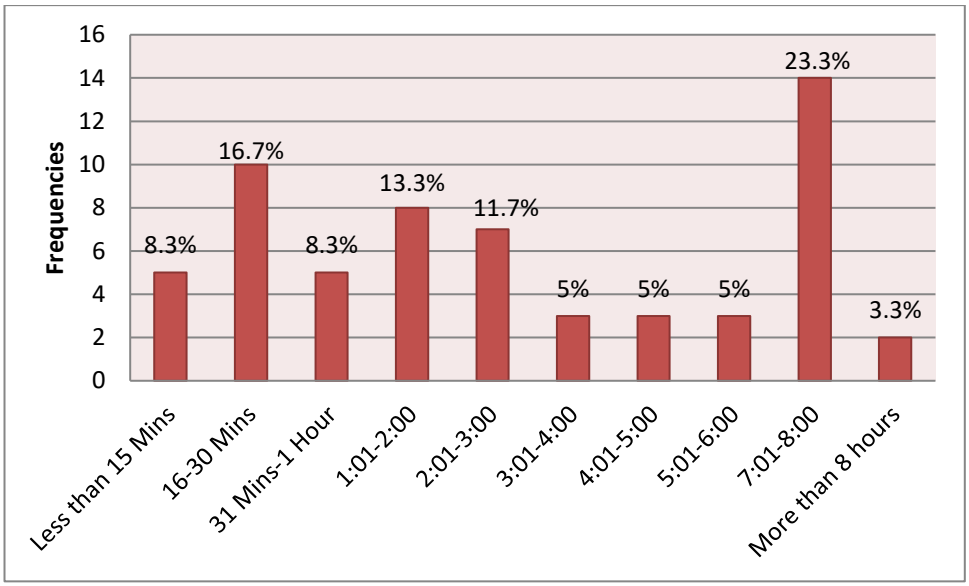


Figure 5.4: Time Spent on Parking Spaces

Source: Field data, 2017

5.2.6.6 Influence of Parking Behaviour on Parking Capacity

The purpose of the visit to Lusaka CBD was found to be similar to that reported for motorists in Ikeja CBD, where the majority of motorists also visited the CBD for business. Other studies by Simićević, et al (2012) found that the users, with the purpose work in Belgrade City with 96,000 inhabitants in the CBD are blocking parking spaces for a longer period and travel during peak hours. Thus, they are deemed undesirable in the city centres. For this study, it was established that 28.3 percent of motorists visit the Lusaka CBD for work and there is only 9.7 percent of off-street parking spaces which are the minority. This implies that the problem of parking in Lusaka CBD may continue existing as long as vehicles are parked for a longer period as this translates into an increase in the demand for parking.

Looking at the information provided in Table 5.2, it is important to note that on average, motorists lose 4 minutes per day walking to and from the parking space to their final destination. Weant and Levinson (1990) conducted parking user studies and found that factors that affect the choice of parking are price, and walking distance to the final destination, although the price is not a determining factor in the Lusaka CBD. Weant and Levinson argue that the walking distance is competing with the cost of parking when deciding where to park. These results proved similar to those obtained in studies conducted in the Nairobi metropolitan area. The walking

time was higher than that of Lusaka CBD at 5.1 minutes because only 47 percent parked at locations close to their destination (JICA, 2006) as compared to the 53 percent for Lusaka CBD. These results further agree with the traffic assignment model as indicated by Austin (1973) that parkers are allocated parking stations depending on walking distance. This means that motorists will prefer parking near their final destination even if it means parking illegally so as to reduce walking time, thus, perpetuating the parking problem in the CBD.

These results conform to the traffic assignment model that arrival rate patterns vary throughout the day (Gur and Beimbourn, 1984). According to Table 5.3, what is coming out is that motorists who arrive before 09:00hours spend less time searching for a parking space than those that arrive later. As drivers spend more time looking for where to park, congestion becomes the resulting effect. Ogunbodede (2004) reports that since motorists spend an appreciable amount of time looking for where to park, congestion and hold-ups become a common phenomenon in the city of Akure. Similarly, Shoup (2006) and his colleagues found that the average search time for parking is 3.3 minutes for all times but was nearly 10 minutes during evening hours.

The average search time of 3.3 minutes may seem insignificant, however, when added up across all of Westwood's drivers (a commercial and residential neighbourhood in the northern central portion of the Westside region of Los Angeles, California), it amounts to 426 hours per day (a little more than 10 work weeks). Dowling et al (2017) reporting the studies done by Shoup Donald add that a majority of drivers spend anywhere in the world between 3.5 to 14 minutes in a typical search for parking space. These times quickly add up to cause significant productivity losses in cities. Therefore, as the study established that on average motorists in Lusaka CBD spend Three minutes searching for a parking space, this would seem too little time but overall, they add up to hours of loss in working time and contribute to traffic problems caused by parking inadequacy.

These results further show that there is no time limit on how much time a vehicle should spend on a parking space in the CBD. This contributes to reducing parking facilities and encourages motorists to park in illegal places. Plate 5.3 shows illegal parking due to lack of parking space. One of the parking supply problems is that parking spaces that are supplied in most African cities are not necessarily used as

efficiently as they could be. For example, in Nigeria, public parking spaces that are available often do not have time limits, as is the case for Lusaka CBD where 23.3 percent vehicles spend about 7 to 8 hours on a parking space. This is as Step and Mint (2012) report that a space in a high demand area for parking may be taken by some individuals for most of the working hours.

Plate 5.3: Illegal Parking due to Lack of Parking Space

Source: Field data, 2017

These results and the subsequent discussion have clearly demonstrated that the study has indeed achieved objective one which sought to assess the existing capacity of parking facilities in the CBD of Lusaka City. Likewise, the research question number one has been answered as the current capacity of parking facilities in the CBD has been established. Furthermore, the behaviour of motorists in connection to the current capacity of parking facilities was also revealed.

5.3 Spatial and temporal traffic volume dynamics in Lusaka CBD

The study also sought to ascertain the volume of traffic at different locations, days, times, and directions in Lusaka CBD. This was done to establish how much volume

of traffic is received in the CBD against the number of parking spaces. This entailed testing for five (5) hypotheses in ascertaining the volume of traffic at different locations, days, times and directions for Lusaka CBD, namely;

i. *Ho: there is no significant difference in the mean hourly traffic volumes on different entry and exit locations for Lusaka CBD*
ii. *Ho: there is no significant difference in the mean hourly traffic volumes for different days of the week*
iii. *Ho: there is no significant difference in the mean hourly traffic volumes at different times of the day*
iv. *Ho: there is no significant difference in the mean hourly traffic volumes for going in and out of the CBD*
v. *Ho: Location, day, time and direction do not interact to affect the mean hourly traffic volumes*

These results were based on one of the important variables of the traffic flow theory, which is volume. Wattleworth (1976) defines traffic volume as the number of vehicles observed in a given time that is based on an actual count and expressed as vehicle.

5.3.1 Spatial variations in traffic volumes - Location

Table 5.4 displays descriptive statistics for the different locations in the CBD. The ANOVA test revealed that there was a significant difference (p = 0.0001) for at least one mean hourly traffic volumes on different exit and entry locations for the CBD. This means that there is sufficient evidence to infer that differences in mean hourly traffic volumes exist for the different entry and exit locations to the CBD.

Table 5.4: Traffic Volumes on Different Locations

Location	N	DF	F-ratio	P - value	Mean (*Veh*)	Standard Deviation
		6	35.47	0.0001		
Ben Bella/Lumumba Rds. Junction	42				700	375
Church/Cairo Rds. Junction	42				987	371

Kabwe Roundabout	42	1514	494
Kafue Roundabout	42	1311	405
Kalambo/Lumumba Rds. Junction	42	969	549
Los Angeles/Lumumba Rds. Junction	42	483	414
Mungwi/Lumumba Rds. Junction	42	542	276

Source: Field Research, 2017

Further analysis was done on the locations to ascertain which location was statistically significant different from the others using the Pairwise Comparison (Table 5.5). This is because ANOVA does not show which factor(s) are statistically different. The results show that Kabwe Roundabout statistically had the highest traffic volume, followed by Kafue Roundabout, the junction of Church/Cairo Roads and Kalambo/Lumumba Roads has similar traffic volume as well as those of Ben Bella/Lumumba Roads and Mungwi/Lumumba Roads. Traffic volume for the junction of Mungwi/Lumumba Roads is not statistically significant different from the junction of Los Angeles/Lumumba Roads but Los Angeles/Lumumba junction was different from Ben Bella/Lumumba junction.

Table 5.5: Tukey Pairwise Comparison of Locations

Location	N	Mean	Grouping		
Kabwe Roundabout	42	1513.9	A		
Kafue Roundabout	42	1311.3	A		
Church Road	42	986.5		B	
Kalambo/Lumumba Junction	42	969.0		B	C
Ben Bella/Lumumba Junction	42	700.3			C D
Mungwi/Lumumba Junction	42	542.0			D
Los Angeles/Lumumba Junction	42	483.0			D

Source: Field Research, 2017

Means that do not share a letter are significantly different.

5.3.2 Hourly Traffic Volumes for the Seven Days of the Week

The mean hourly traffic volumes for the different days of the week are as shown in Table 5.6. The ANOVA test revealed that at least one mean for hourly traffic volumes of days differ, p=0.0001.

Table 5.6: Traffic Volumes on Different Days

Day	N	DF	F-ratio	P - value	Mean (*veh*)	Standard Deviation	Sum (*veh*)
		6	9.08	0.0001			
Sunday	42				488	464	20486
Monday	42				1207	456	50685
Tuesday	42				1055	340	44317
Wednesday	42				1018	384	42745
Thursday	42				973	632	40856
Friday	42				1012	586	42501
Saturday	42				754	572	31661

Source: Field Research, 2017

The pattern from Monday to Friday is often relatively consistent. However to know which days were statistically significant different from the others, a further test was done using the Pairwise Comparison. The results revealed that Monday has the highest traffic volume but not significant different from Tuesday, Wednesday and Friday (Table 5.7). There is no significant differences in traffic volumes for Tuesday, Wednesday and Friday, hence it can be concluded that they have similar traffic volumes. However, despite Thursday not being different from Tuesday, Wednesday and Friday, it had lower traffic volumes than Monday. Saturday was lower than all the weekdays and Sunday being the lowest all the days.

Table 5.7: Tukey Pairwise Comparison of Days

Day	N	Mean	Grouping		
Monday	42	1206.8	A		
Tuesday	42	1055.2	A	B	
Wednesday	42	1017.7	A	B	
Friday	42	1011.9	A	B	
Thursday	42	972.8	A	B	
Saturday	42	753.8		B	C
Sunday	42	487.8			C

Source: Field Research, 2017

Means that do not share a letter are significantly different

The sum (Table 5.6) shows a higher demand for parking spaces than supply (4598 parking spaces) in the CBD. On average, the CBD receives 44221 vehicles for working days, and weekends receive 26074 vehicles. This increases congestion in the CBD and further contributes to increased time spent searching for a parking space for motorists. There is more traffic during the weekday than weekend day due to people visiting the CBD for various purposes such as work, shopping, business, entertainment, commuting, and education. The activities mostly done on weekends are business and shopping. Religion also plays a role as weekends are taken to be days of worship and most places of worship are in residential areas which are not provided for in the CBD, hence the lower CBD figures for the weekends.

5.3.3 Temporal variations in traffic volumes - Time

The mean hourly traffic volumes for the different times of the day indicate that there was no significant difference (p=0.816) in the mean hourly traffic volumes for the three different hours of the day sampled. Table 5.8 shows the results for traffic volumes at different times of the day.

Table 5.8: Traffic Volumes on Different Times

Time	N	DF	F-ratio	P - value	Mean (*veh*)	Standard Deviation
		2	0.20	0.816		
07:30 – 08:30	98				933	623
12:30 – 13:30	98				953	527
15:30 – 16:30	98				903	492

Source: Field Research, 2017

The constant volume of traffic in the CBD can be attributed to the dominant commercial land use that attracts more traffic than other uses. In addition, important institutions such as the Bank of Zambia and other big commercial Banks, National Milling Company, and the Post Office are all located in the CBD on Cairo Road. The CBD also acts as the connector to other neighbouring districts of Lusaka. Further, the CBD serves as the shortest route to the industrial area located to the west and northwest of the CBD. All these attract traffic flow through the CBD and the implication is that parking provision, management, pricing, and enforcement should be constant throughout the day.

5.3.4 Hourly Traffic Volumes for Different Directions (IN and OUT)

The IN direction show that it receives higher traffic volume with a mean of 1034 than the OUT direction whose mean stands at 825 (Table 5.9) The ANOVA test for these means revealed that there was a significant difference (p=0.001) between the two directions. Therefore, the evidence is sufficient to conclude that the differences in mean hourly traffic volumes exist between IN and OUT directions. The difference in the volume of traffic can be ascribed to the mode of transport used in going to the CBD. For instance, people use private vehicles to go for work in the CBD which will be parked until the time of knocking off. This creates a difference in traffic going in and out of the CBD. Another reason is that people go to the CBD for various purposes and spend different time in the CBD. Table 8 shows the results for mean hourly traffic volumes in different directions.

Table 5.9: Traffic Volumes on Different Directions

Direction	N	DF	F-ratio	P-value	Mean (*veh*)	Standard Deviation
		1	11.0	0.001		
IN	147				1034	596
OUT	147				825	476

Source: Field Research, 2017

This means that when some vehicles enter the CBD, they remain parked and do not come out at every hour of the day. Since it has been established that the difference is significant, adequate parking spaces for these vehicles need to be provided and managed.

5.3.5 Interaction between Factors (Location, Day, Time and Direction)

In order to determine if volumes of traffic are affected by an interaction of location, day, time and direction, an ANOVA statistical test was done. There are six combinations of interaction for these four factors (Table 5.10).

Table 5.10: Interaction between Factors

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Location*Day	36	15638137	434393	5.08	0.0001
Location*Time	12	476768	39731	0.22	0.998
Location*Direction	6	1172727	195455	1.18	0.315
Day*Time	12	1602834	133570	0.50	0.912
Day*Direction	6	1748487	291414	1.18	0.317
Time*Direction	2	1591479	795740	2.75	0.065

Source: Field Research, 2017

However, the ANOVA results indicate that only the interaction between Day and Location is statistically significant (p=0.0001) as the other interactions are not significant. This entails that the relation between Day and traffic volumes depends on the location of entry/exit point of the Lusaka CBD (Figure 5.5).

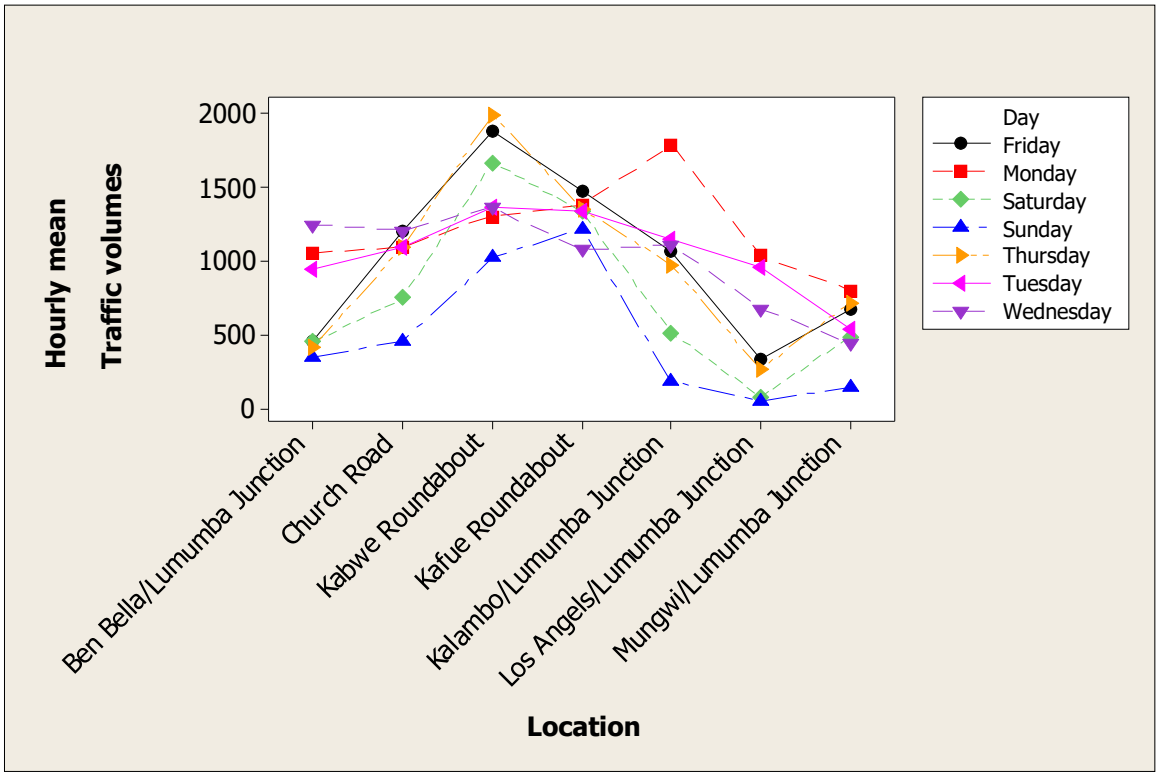


Figure 5.5: Interaction Plot between Day and Location
Source: Field Research, 2017

5.3.6 Impact of Traffic Volumes on Parking

The results presented in Table 7 reveals that weekday's traffic volumes are more than weekend's traffic volumes. These volumes of traffic are too high for the parking spaces that are provided in the CBD and especially where it has already been established that 23.3 percent motorists spend about 7 – 8 hours parked in the CBD. Therefore, without proper management of parking, these volumes of traffic will create a parking problem and force many motorists to park their vehicles illegally. This also implies that parking regulation should be stricter on weekdays than weekends.

These results show a similar trend with a traffic count study that was done by Adigun (2013) on a section of Ikorodu-Sagamu Road located in the northern part of Ikorodu. The study showed that the weekdays had more volume of traffic than weekends. However, the results show a different traffic pattern with the Ikorodu study where a high volume of traffic was recorded in the morning from 7.00am to 11.00am. Thereafter, the traffic volume dropped during the mid-afternoon from 11.00am to 3.00pm. The traffic volume surged upward again in the evening from 3.00pm to 7.00pm. The differences in traffic volumes in Lusaka CBD at different times of the

day are insignificant. This means that parking provision and management should be done constantly throughout the day if the parking problem is to be solved. Thus, to enable parking supply to respond effectively to desired demand patterns as part of a transport demand management strategy, providing parking availability in 'hours' rather than 'spaces' would enable variance in supply levels (Salomon, 1986).

In terms of traffic volumes at different locations, the results in Table 6 clearly show that traffic volumes differ at different localities. What is coming out is that the Kabwe and Kafue roundabouts receive more volume of traffic than any other location. This can be attributed to the fact that these two localities are connected by Cairo Road which hosts government institutions, National Milling Corporation, , Post Office, , big Commercial Banks (ZANACO, Barclays, Atlasmara, Indo Zambia Stanchart), Building Society, Shopping Malls, Institutions of learning etc. that attract vehicular traffic and more parking space.

These results are in line with results from studies that were done at two intersections, Lafenwa, and Ibara in Abeokuta local authority, Lagos where it was also found that traffic volumes differ at different locations. Generally, traffic volume at Ibara intersection was heavier compared to Lafenwa Intersection. Ibara intersection's vicinity is a CBD where banks, eateries, shops and market, schools, government ministries, and parastatals are located (Olaleye et al, 2009). Teknomo and Hokao (1997) state that the activities in a city are mainly concentrated in the CBD and these activities demand more parking spaces. Unfortunately, increasing the number of parking spaces is restricted by the limitation of land area.

People visit the CBD for various reasons. The parkers' behaviour in choosing a parking location is distinct by trip purpose and other factors as indicated from the study done by Teknomo and Hokao (1997). Each trip purpose has its own parking duration. Parking duration for shopping and recreation trips is shorter than a business trip. On the other hand, the working trip has the longest duration. It is this difference in parking duration that creates a difference in the volume of traffic for coming in and going out.

The results for this study have revealed a significant difference between the traffic coming in and going out with less traffic volume going out of the Lusaka CBD. This

implies that, for vehicles that enter Lusaka CBD, some will remain there and demand parking space. These results on directional traffic volumes are similar to what was found at Lafenwa intersection where there was a significant difference in the average hourly traffic volume of the incoming and outgoing traffics. Also, the average hourly traffic volume of the incoming traffic (484.1) was greater than the outgoing traffic (431.3) (Olaleye *et al,* 2009).

5.4 Adequacy of the governing legislation and regulations for parking

The study found that parking in Zambia is regulated by the following statutes;

i. Constitution of Zambia
ii. The Local Government Act No. 22 of 1991 Chapter 281 (GRZ, 1991)
iii. The Public Roads Act No. 12 of 2002, Chapter 261 (GRZ, 1992)
iv. The Road Traffic Act No. 11 of 2002, Chapter 105 (GRZ, 1992)
v. The Urban and Regional Planning Act No. 3 of 2015, Chapter 23 (GRZ, 2015)

Further, it was found that parking in Lusaka City is guided by the following development plans;

i. Comprehensive Urban Development Plan for the City of Lusaka (JICA, 2009)
ii. The Doxiadis Lusaka Development Plan (Doxiadis, 1975).

Nevertheless, the study shows that the urban transport development of the plan which has a section on how to plan for parking in the city has not been implemented. Therefore, the Doxiadis Lusaka Development Plan is still guiding plans for parking in Lusaka City. It was also established from the LCC key informant that the city has no parking policy for parking provision, management, regulation, enforcement, and pricing that would help to operationalise the statutes.

The Local Government Act CAP 281 (18) under the functions of the council mandates the local authority "to control traffic and the parking of vehicles and, for that purpose to establish and maintain parking meters and premises for the parking of vehicles." The Act in Section 20 gives powers to punish heavy vehicle parking in any unauthorised places. A review of the Act further revealed that Councils have the power to formulate by-laws as provided for in Section 76 of the Act which states: "a council may make by-laws for the good rule and government of its area" (GRZ, 1991

p. 45). However, a key informant from LCC revealed that the Local Authority has not formulated any by-laws which could assist in regulating parking in the city, especially in the CBD where parking problems are insurmountable.

Under the Road Traffic Act (2002), no person shall fail to comply with any direction conveyed by a road traffic sign displayed in the prescribed manner. Any person that fails to comply with this commits an offence and is liable upon conviction, to a fine or imprisonment for a term not exceeding 6 months or to both. However, compliance is very low as several vehicles were seen parked in undesignated areas. Plate 5.4 illustrates failure by a motorist to comply with the parking sign. However, this does not apply to vehicles such as fire brigade, ambulance, or police purposes.

Plate 5.4: Failure to Comply with a Parking Sign

Source: Field data, 2017

Section 186 (1) of the Road Traffic Act prohibits motorists to park on pedestrian crossings or encroaching upon the sidewalk in any way. There is little compliance of this provision as motorists where found parked on pedestrian crossings and sidewalks. Paradoxically, the enforcement of this provision has been difficult for Parkrite Zambia because, for such offenders, their vehicles need to be clamped as provided in the Parkrite parking regulations until a fee of 450 ZMW is paid. Despite

this provision, no vehicle was found clamped for parking on a pedestrian crossing and sidewalk. Plate 5.5 gives this illustration. Failure to enforce this provision is attributed to a shortage of human resource and transport that will enable the authorities to move around and identify offenders.

Plate 5.5: Parking on Sidewalk and Pedestrian Crossing

Source: Field data, 2017

Non-compliance of this provision can be seen in the majority of motorists (58.3 percent) that considered parking illegally (in undesignated spots) when they got to the CBD compared to the 41.7 percent that did not consider parking illegally.

The Road Traffic Act 2002 and the Public Roads Act 2002 give sole responsibility to the local authorities to levy any charge for parking on any public street. In Lusaka CBD, the collection of parking fees is done by Parkrite Zambia through their parking marshals on behalf of Lusaka City Council. However, call boys locally known as *Ngwangwazi* are young men found on any section of the road especially bus station or bus stop calling for people to board on buses and demand money from public bus operators once the bus is full. The call boys were seen to collect parking fees and pocket the money for their personal use. One parking marshal lamented:

> "Call boys collect parking fees and there is nothing we can do as they, in some instances threaten to beat us if we retaliate. They also claim to

> belong to a certain political party, which they believe gives them the power to collect parking fees from motorists. Unfortunately, some motorists are more comfortable giving money to the call boys than us because call boys promise to take care of their vehicles."

The Public Roads Act, 2002, states that the period for which a vehicle may be lawfully parked in a parking bay shall be measured by the parking meter for the bay. In terms of this provision, it was found that there are no time limits for parking in the CBD on any section of the road. Since the Act does not have a provision to allow Councils to restrict motorists from parking for longer time in a parking space on any section of the road, this has contributed to the problem of parking space inadequacy. Motorists, park for longer hours as parking time is not regulated, especially in busy sections of the CBD. And as established earlier, about 23.3 percent most motorists parked for more than Seven hours. Shoup (2006) contends that such issues of parking shortages can be dealt with by setting up time limits on certain parking spaces, especially in busy areas.

Furthermore, the Act empowers any local authority to establish upon a public road, within the area of its jurisdiction, ranks or stands to be known as special parking places, for the parking of passenger-carrying motor vehicles or any class of vehicles and may make by-laws. There are no special parking places in the CBD as LCC has failed to implement this section of the Act by not creating any. This has led to passenger-carrying motor vehicles such as taxis to operate from anywhere in the CBD, creating a problem of parking space inadequacy.

The Public Roads Act, 2002, adds that all fees collected by a local authority by means of a parking meter, or a respect of any parking area or special parking places, shall be used to defray the cost of, and incidental to, any scheme, work or undertaking for the improvement or regulation of traffic conditions within the area of the local authority. This includes the costs of installation and maintaining any parking meter, parking area or special parking place. Enforcing this section of the law has been a challenge. A key informant from LCC revealed that making improvements to parking spaces has been a challenge because once the parking fees are collected, they are combined with other collections and channelled to work on other priority issues such as garbage collection and street lighting.

With regards to vehicle security, the exercise by a local authority of its powers shall not render the local authority subject to any liability in respect to the loss of or damage to any vehicle or the contents of fittings of any vehicle while the vehicle is in a parking area or special parking place. Therefore, the local authority does not provide any security and no security system has been installed in parking spaces in the CBD. Thus, parking in the CBD is at owner's risk despite paying parking fees. This is similar to the Polokwane Local Municipality Parking By-law under Section 29 that the Municipality is not liable for the loss of or damage howsoever caused, to any vehicle which has been parked in a designated parking bay (Polokwane Local Municipality, 2018).

Personal safety and vehicle security are important factors to choose where to park. Teknomo and Hokao (1997) in Urban Car Parking Modelling found that security was the most important factor to choose where to park by users of parking facility. Caicedo et al. (2006) found 60 percent of respondents considered safety and security when deciding on which level to park within a multi-storey facility. Figure 8 demonstrates that most motorists (63.3 percent) in Lusaka CBD feel their vehicles are not safe. This means that a motorist would park anywhere (illegally) and even opt to pay a call boy just to ensure that the vehicle is secure.

The Urban and Regional Planning Act guides spatial development in the nation. A review of the Act has shown that there is no provision for the regulation of parking. The act only states in section 69 that Compensation shall not be payable to the manner in which any land is to be laid out for the purposes of the development, including the provision of facilities for parking (GRZ, 2015).

The Doxiadis Lusaka Development Plan mandates every developer in the City to provide for parking of vehicles in accordance with the planning standards approved by LCC (Table 5.11). The plan does not indicate any provision for parking for the CBD but only gives provision for different land uses that can be found in the CBD.

Table 5.11: Parking Requirements/Standards for Lusaka City

S/N	Land Use	Standards
1	Offices	1 space/100m^2 floor space
2	Hotels/motels	1 space/1 bedroom
3	Shops	5 spaces/1000m^2
4	Place of Worship	1 space/8 seats
5	Industry	1 car (space)/10 employees
6	Warehousing and Wholesale Premises	1 lorry (space)/1000m^2

Source: Doxiadis Limited (1975)

The plan seems to have been over-ambitious for the capital city of a developing country. These standards were made at a time when Lusaka's vehicle population was less than 1725 vehicles which was the total national vehicle population at independence (Nanchengwa, 1990). Therefore, these standards are out-dated and no longer serve their purpose as the vehicle and shops population for the city has since increased tremendously.

The Lusaka Comprehensive Master Development Plan was prepared in 2005. It recognises the following as major parking problems in the City; illegal parking on road side, especially in the CBD area, and lack of on-street parking space and off-street parking lot. Therefore, the plan provides for legislation of new building code and construction of parking lots, especially off-street parking lots. It recognises the need to strengthen enforcement of illegal parking at prohibited places and the introduction of a time-zone parking space in areas with high parking demand. The major weakness of the plan is that it is silent on what type of enforcement that need to be strengthened and has not made any provision of what the new parking requirements or standards should be based on the 2005 vehicular population in Lusaka City. However, it's been 14 years and it will require revision before being implemented as vehicle population has farther increased.

The regulations on parking do not provide for penalties for those taking up parking spaces to sell vehicles or to repair them. This is converse to what is provided in parking legislation in Polokwane Municipality where in Section 8 and 9 prohibit the sell and repair of vehicles on any part of the road (Polokwane Local Municipality, 2018). In England also, Part 2 of the Clean Neighbourhoods and Environment Act 2005 provides for the prevention of individuals parking vehicles on the street in order to sell them; and to prevent individuals parking vehicles on the street in order to carry out repairs in the course of a business (Butcher, 2016).

The parking legislations in Lusaka CBD do not provide for an extension to the Police to help local authorities deal with illegally parked vehicles like they do in England where local authorities and the police have the power to remove a vehicle if it is illegally parked, causing an obstruction or has been abandoned. The power to remove vehicles is given to the police by sections 99-102 of the *Road Traffic Regulation Act 1984*, as amended, and by the *Removal and Disposal of Vehicles Regulations 1986 (SI 1986/183)* (Butcher, 2016).

Parking legislations in Lusaka do not provide for a development of a parking policy that should be derived from the range of parking problems identified city-wide and the CBD in particular. As it is, all the legislations are general and LCC has not made any by-law regarding parking because of bureaucracy involved. This makes the legislations hard to enforce because there is no enforcement plan for illegal parkers which a parking policy should contain as provided for in the Cape Town City Parking Policy (Cape Town City Council, 2014).

Parking in Lusaka CBD: a product of inadequate legislation, lack of a parking policy and weak enforcement

Proper management of parking on public roads is essential to ensure the smooth flow of traffic and to allow drivers to park near their destinations. It is imperative that parking restrictions, as well as penalty charges are imposed on those who do not comply (Elliot, 2010). Conversely, as seen in the findings, despite the existence of legislation on parking, the state of parking in Lusaka CBD remains undesirable. This state of affairs in the CBD can attributed to the lack of a parking policy by the local authority and Parkrite Limited. This has also resulted in a lack of clear policy

direction as to which agency is responsible for collecting of parking fees in the CBD. This in turn has had implications on enforcement of regulation.

The growth in the number of vehicles has not been matched with the development of transport infrastructures such as car parks. This growth has also not led to a review of the legislation which remains outdated (Doxiadis plan). Even more so, no important provisions have been made to regulate parking. This has resulted in a problematic system where the legislation is not operationalized, thus forcing enforcement to remain weak. In addition, there is little cooperation from traffic control agencies to enforce the law.

As it stands, the parking authority in the CBD has a shortage of resources to ensure maximum compliance of the law. This has led the local authority's financial gain from parking to be very low, thus, resulting in less or no investment in parking infrastructure and unregulated parking in the CBD. Illegal parking has affected the appearance of most roads in the CBD and impacted on safety for road users. Therefore, lack of proper parking management in Lusaka CBD is as a result of an inadequate legislation, lack of a parking policy and a weak enforcement of the law.

In conclusion, this chapter highlights the key research findings on the parking capacity of the CBD, the traffic volume that goes in and out of the CBD at different hours of the day and different days, as well as the legislation that governs parking. The findings suggest that there is a parking problem in Lusaka CBD caused by too many on-street parking spaces, misuse of parking spaces, vehicle insecurity, long parking time, high volumes of traffic, inadequate parking legislation, lack of a parking policy, and weak enforcement of parking legislation.

CHAPTER SIX
CONCLUSIONS AND RECOMENDATIONS

The aim of the study was to examine the problem of parking facilities in the Central Business District of Lusaka City. In addressing the aim, the study sought to assess the existing capacity of parking facilities in the CBD, to ascertain the volume of traffic at different locations, days, times and directions for Lusaka CBD, and finally to assess the adequacy of the governing legislation and regulations for parking as it applies to Lusaka CBD.

6.1 Conclusion

The first objective showed that the Lusaka CBD has only 4598 parking spaces. Also, the main parking facility in the area is on street parking which accounts for over 90 percent parking slots. The capacity of parking was found to be reduced by the following factors; vendors who have mounted permanent structures on parking slots, car dealers and taxi operators who stay on parking slots for long hours, and the increased number of minibuses that can no longer be accommodated by the bus stations in the area and so they end up taking parking slots meant for the general public as they wait to load.

It was further found that parking slots are reduced more during the rainy season because the drainages in parking lots are blocked and get flooded. Another important finding was that some sections of the CBD have no parking signs. This makes it difficult to establish whether vehicles are parked legally or not. The estimated time of Five hours 30 minutes spent on a parking lot was found to be too much for the CBD. The entire CBD has no time limits for parking, further fuelling the parking problem.

Regarding the second objective, the volumes of traffic differ significantly at different entry and exit locations to the CBD. They also differ for different days of the week and directions. Only the period was found not to differ significantly, meaning the volume of traffic was constant throughout the day. In addition to the parking capacity problems, the total volume of traffic for different days was found to be more than the parking supply, thus making parking facilities in the CBD inadequate. Since the time of day was insignificant, therefore, time did not affect volume of traffic at any day of the week and for any direction of the CBD.

The parking legislations were found to be inadequate. This is because they lacked important clauses to manage parking. Some of the clauses they lack are; provision for vehicle security in parking lots and prohibiting car dealers and car washing services in parking lots. Since the City has no parking policy, it is difficult to have time limits for parking and designate taxi ranks in the CBD. This is because a policy will address a particular problem, unlike a legislation which is too general and operates at a national level. In addition, parking standards/requirements are out-dated as they were developed at a time when the vehicle population in the city was small.

The overall conclusion for the study is that the parking problem exists in the Lusaka CBD due to the fact that the parking spaces operate below the demand for parking in the area. This is as a result of the nature of land use (dominantly commercial) in the area which attracts vehicle traffic. Moreover, the legislation is inadequate and lack enforcement.

6.2 Recommendations

In light of the findings of this research, the following recommendations are suggested to deal with the challenges of car parking in Lusaka CBD:

1. Old buildings in central business districts should be refurbished to accommodate adequate parking space using the multi-story building structure, for example, the building opposite the post office on the junction of Katondo Street and Freedom Way. This will gradually shift to off-street parking in the city centre. In the longer-term, it will be desirable to eliminate on-street parking on many streets in the CBD to free up space for pedestrians and other activities, as well as improve urban design. This recommendation could be spearheaded by LCC and other private entities that could wish to manage parking facilities in the CBD so as to eliminate on-street parking.
2. Parkrite Limited should encourage shared parking were parking spaces can be utilized by multiple users. Motorists can share parking space available, rather than it being assigned as a reserved parking space.
3. The Road Traffic Act need to be amended to include clauses that prohibit car dealers operating on parking spaces, prohibit car washing on parking spaces, extend management of parking to other agencies such as the police

and provision of vehicle security in parking lots. Furthermore, the Ministry of Transport and Communications should ensure that every institution involved in parking management should have a policy that must give guidance on how long a vehicle must be parked in a car park.

4. The parking policy to be introduced need to address the methods used to compute and/or to adjust the parking price in order to subdue the resistance of parking pricing. These methods must accommodate various payment methods (bill, credit, debit cards, etc.) charged only for the amount of the time parked.
5. Additionally, LCC and Parkrite Limited must formulate an enforcement plan that will help to reduce the problem of parking in Lusaka CBD. Physical design is probably the most important way to strengthen enforcement of on-street parking (especially parking on walkways). However, this needs to be complemented by a stronger enforcement approach, with ticketing and/or towing of illegally parked vehicles.

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APPENDICES

Appendix A: IQuestionnaire for Motorists

The University of Zambia

Department of Geography & Environmental Studies

QUESTIONNAIRE FOR MOTORISTS

Note: The answers provided in this questionnaire are purely for academic purpose and meant to help the interviewer write their dissertation for their Master of Science in Spatial Planning. Thus, any information given will be treated with the strictest confidence.

Researcher's Name: Chipili Sydney

Institution's Name: University of Zambia

Contact: Mobile – 0979-721384, email address: syd.chipili@gmail.com

Date: …….

Title**: Improving Parking Facilities in the Central Business District of Lusaka City**

Respondent # ……. Name of Street …… Day of Survey …….

Month of Survey…….. Weather conditions on day of survey …….

Section A: Background information

1) Sex of respondent

Male	Female

2) To which age group do you belong?

Less than 26	26 – 35 years	36 – 45 years	Above 45 years

years			

3) How many years have you held a driving licence?.....

4) What is your approximate Annual Income?

Less than 2000	2001- 4000	4001 - 6000	Above 6000

Section B: questions on aspects of parking

1) Where did you travel from?.....

2) What type of parking place have you chosen to park in for this particular trip?
   i. On-street (free)
   ii. On-street (metred)
   iii. Off-street (free)
   iv. Off-street (payment required)
   v. Multi-storey

3) What is the purpose of parking at the particular destination where you have parked?

Commuting	Business	Education	Work
Personal Business	Social or Entertainment	Shopping	Multiple Purpose

4) Are there any parking signs in the area?

Yes	No

5) Do you usually park in your chosen parking place when you visit the CBD?

Always	Frequently	Sometimes	Rarely	Never	This is my first visit

6) How would you describe vehicle security in your choice of parking place?

Very Unsafe	Fairly Unsafe	Neither Unsafe nor Safe	Fairly Safe	Very Safe

7) To what extent is your personal safety a factor in selecting a parking location?

Very Unimportant	Fairly Unimportant	Neither Unimportant Nor Important	Fairly Important	Very Important

8) What time did you park at your parking place?

7:00 - 7:59	8:00 - 8:59	9:00 - 9:59	10:00 - 10:59	11:00 - 11-59
12:00 - 12:59	13:00 - 13:59	14:00 - 14:59	15:00 - 15:59	16:00 - 16:59

9) How long did you spend searching for your parking space?

0 Min	Less than 1 Min	1 – 5 Min	6 – 9 Min	10– 13Min	14– 17Min	More than 17 Min

10) How long do you intend to park in your chosen parking space?

Less than 15 min	15 - 30 min	31 - 59 min	1:00-1:59 hours	2:00-2:59 hours	3:00-3:59 hours
4:00-4:59 hours	5:00-5:59 hours	6:00-6:59 hours	7:00-7:59 hours	More than 8 hours	

11) How long does it take you to walk to your destination?

Less than 1 min	1-5 min	6-10 min	11-15min	16-20 min	21-25 min	More than 25 min

12) Is a parking charge applicable for your chosen parking place?

Yes	No(Free parking)

13) Did you consider parking illegally?

Yes	No

14) Did you research potential parking places before arriving in the CBD (such as on the Internet)?

Yes	No

15) Did you have any assistance in finding a parking place (such as a parking marshal or call boys directing you)?

Yes	No

16) What could you suggest to relevant authorities on how parking should be improved in the CBD?

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Appendix B: Interview guide for Lusaka City Council

The University of Zambia

Department of Geography & Environmental Studies

Interview guide for Lusaka City Council

Note: The answers provided in this interview are purely for academic purpose and meant to help the interviewer write their dissertation for their Master of Science in Spatial Planning. Thus, any information given will be handled in strictest confidence.

1. What do you consider to be the main transport issues affecting Lusaka CBD?
2. Do you consider parking problems to be an issue in Lusaka CBD and, if so, how serious an issue would you perceive it to be in relation to other transport issues?
3. What do you consider to be the most significant parking issues in Lusaka CBD?
4. How safe are parking spaces in the CBD (Signs)?
5. Are there any specific factors in Lusaka that you think influence the likelihood of parking problem occurring?

6. Are there specific groups of motorists (for example, shoppers, tourists, commuters, leisure users) whom you believe are more or less likely to search for parking? If yes, what do you perceive to be the reasons for this?
7. In your experience, does the level of parking problem vary according to the time of day, day of the week, or time of year?
8. Are there areas of Lusaka CBD in which parking problem is more likely to occur and if so, in which areas?
9. How is the parking fee used?
10. Do you think the parking problem has changed over time? If so, in what ways and why?
11. If parking is perceived as a problem in Lusaka CBD has Lusaka city council implemented any parking management policies in order to address this problem?
12. If 'Yes' in Q10, what measures have been introduced and how effective have these been in addressing the issue of parking and wider transport issues?
13. Have there been wider benefits arising from the policy implementation and, if so, what are they?
14. In addition to policy measures which may have been identified in the previous question, what do you believe are possible solutions to address the issue of parking problem? What might be the challenges of implementing these solutions (for instance cost or public acceptability) and how might these challenges be overcome?
15. In your view, what are the likely future developments in parking problem? Do you think parking will become a greater or lesser issue and what are the reasons for your response?
16. What do you consider to be the likelihood of Lusaka City Council adopting policy measures to address parking problems in the future, and how would such measures fit with the current objectives of Lusaka City Council?

Appendix C: Interview guide for Parkrite

The University of Zambia

Department of Geography & Environmental Studies

Interview guide for Parkrite

Note: The answers provided in this interview are purely for academic purpose and meant to help the interviewer write their dissertation for their Master of Science in Spatial Planning. Thus, any information given will be handled in strictest confidence.

1. When did you start your operations
2. What is the scope of your operations?
3. How many parking spaces do you manage in the CBD
4. How many vehicles enter the CBD each day?
5. Is parking adequate in the CBD? If NOT, what is the shortfall?
6. What are the causes of parking inadequacy in the CBD?
7. How are you managing the parking spaces, what are the challenges?
8. What is the role of call boys in parking?
9. How much do you charge these parking spaces, and are motorists willing to pay? If not, what could be the reasons?
10. What criteria do you use for charging these parking spaces?
11. In your experience, does the level of parking problem vary according to time of day, day of the week, or time of year?
12. Are there areas of Lusaka CBD in which parking problem is more likely to occur and if so, in which areas? And why?
13. How safe are parking spaces in the CBD?
14. Do you have a parking policy that guides your operations, if NOT, what regulates your operations?
15. What are your future plans for improving parking in the CBD?

Appendix D: Interview guide for Road Transport and Safety Agency

The University of Zambia

Department of Geography & Environmental Studies

Interview guide for Road Transport and Safety Agency

Note: The answers provided in this interview are purely for academic purpose and meant to help the interviewer write their dissertation for their Master of Science in Spatial Planning. Thus, any information given will be handled in strictest confidence.

Title**: Improving Parking Facilities in the Central Business District of Lusaka City**

1. What is the vehicle population for Lusaka?
2. What is the trend of vehicle population from 2007 to date in Lusaka?
3. What is your role in managing/regulating parking?
4. Is parking adequate in the CBD, if NOT, what are the causes of parking inadequacy?
5. Have you recorded any accidents in the CBD due to parking problems? If YES, what are the trends in these accidents?
6. What would you suggest that relevant authorities do to improve parking in the CBD?