PARKING DEMAND AND SUPPLY IN THE CENTRAL BUSINESS DISTRICT OF KADUNA.

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DEDICATION.

Dedicated to my parents, Mal. Musa Haruna (Tafidan Jaba) and Mrs Jessie Haruna.

DECLARATION.

I declare that this thesis is composed by me out of my research work on Parking Demand and Supply in the Central Area of Kaduna Metropolis. It has not been previously accepted in any undertaking for the award of any higher degree. Quotation marks and references have been used respectively to acknowledge all sources of information.

Saratu

This is to certify that this thesis entitled PARKING SUPPLY AND DEMAND IN THE CENTRAL BUSINESS DISTRICT OF KADUNA by HARUNA, Saratu Musa meets the regulations governing the award of the degree of M. Sc. (URP) of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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ABSTRACT

The Central Business District (CBD) of any city is its economic, political and social nerve centre. Because of those activities large numbers of vehicles are attracted there. There are several parking problems experienced in the Kaduna CBD.

This study focused on measuring the parking demand and supply in the Kaduna CBD. The object is understanding the charactersitics of parking in the CBD as a basis for making recommendations for effective planned provision of parking facilities. Quantitative and qualitative characteristices of parking, including aspects of parking durations in the CBD were surveyed.

For the purpose of the study, the CBD was divided into four landuse sectors. Parking deficits and surpluses in the different sectors were determined. Some of the findings in the study include the fact that parking facilities *are* in short supply in all the sectors. The entire CBD is in short supply of public parking areas especially for long-term parking. Most of the private business/commercial centres of the CBD use kerbsides for parking. This practice is found to be responsible for a high percentage of traffic hold-ups experienced especially along busy streets like Ahmadu Bella Way, Ibrahim Taiwo Road and Broadcasting Road.

Having established the level of demand fur parking facilities the study set out to examine and establish the space requirements to meet the present and future levels of parking demand. Against

the background of the findings, recommendations were made for surface parking within the CBD. Recommendations were made both for on-street and off-street parking at the areas" considered most appropriate. Two design proposals were made, one for on-street parking and the other for off-street parking. Other general policy recommendations were made for parking in the CBD as well as for further research.

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Dr J.B. Kaltho took personal interest in this work. He used his valuable time and resources to supervise, criticise and give meaningful contributions. I am indepted.

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Chapter One: DESIGN OF THE RESEARCH

1.1 INTRODUCTION:

Terminal or parking facilities are an integral part of any transport system. It is therefore necessary that they are covered in urban transport planning exercises. This involves measuring existing demand for parking and projecting future demand levels in the urban centres.

Parking of vehicles at various points along the transport network needs various facilities, the provision of which should be on a planned basis. A planned development of parking facilities is associated with some advantages which include faster travel time or decrease in travel delays, increase in trasit usage, reduction of air pollution, etc. If the provision of the terminal facilities is not properly planned, however, there would be problems such as congestion, frustration, etc. In particular, this can lead to decline of the economic and social value of city centres.

1.2 THE RESEARCH PROBLEM:

The rate of urban growth in Nigeria has been rapid in the past few years, especially since the oil boom in the 1970s. Such rapid growth has been taking place against the backdrop of development preceeding physical planning. The implication for physical infrastructure and facilities is that the supply lags behind demand. For urban transport, the effects include congested streets during peak hours and inadequate parking spaces. Vehicle ownership was reported to be rising at the rate of about 2% per annum during the 1970s. Although the Federal Ministry of Transport has given that total vehicle fleet has declined at an

average rate of 10% per annum between 1985 and 1989, urban vehicle ownership rate is still rising. In such a situation the prospects for smooth vehicular movement and parking in the central areas of growing Nigerian cities look bleak.

Kaduna is one of the major cities in Nigeria where the problem of parking facilities have become established and needing planned intervention. Its population is estimated to be growing at the rate of 8% per annum (Kulshrestha, et al, 1984). Parking facilities are inadequate in some parts of its Central Business District (CBD). As a result, motorists often have to go from one parking space to another looking for where to park. This is most noticeable during peak hours (7-8:30 am, 12-1 pm, 3-4:30 pm). Failure to find parking spaces leads to motorists parking at any available open space an on-streets. This has led to traffic congestion and delays in the Kaduna CBD.

In spite of these problems, government policy in the transport sector has laid emphasis on the provision of public bus service. Little attention has been paid to other aspects of the road transport system such as vehicular parking. In 1984, the Kaduna State Government commissioned a firm of Consulting Engineers, PECSTON, to conduct a transport study in Kaduna town. Parking was, however, discussed in only three short paragraphs of the report. There is, therefore, the need for a study to focus on this neglected aspect of the road transport system, that is, vehicular parking. This research sets out to contribute in filling that gap. In the investigation, the major elements to be emphasised are:

a) analysis of the existing and proposed landuses in the Kaduna CBD;

b) examination of the existing supply and use of parking facilities in the CBD as well as the problems;

c) determination of the existing and future demand levels for parking in the Kaduna CBD;

1.3 AIM AND OBJECTIVES:

1.3.1 Aim:

The aim of the study is to examine the characteristics and problems of parking supply and demand at the Kaduna CBD and make planning recommendations for improvement.

1.3.2 Objectives:

The objectives set towards acheiving the aim are as follows:

1) To review the concepts and determinants of parking demand and supply as well as the methods of measuring parking demand;

2) To evaluate the existing planning policies, supply and use of parking facilities at the Kaduna CBD, as well as the associated problems;

3) To determine the existing demand for parking facilities at the CBD;

4) To make projections for the demand for parking facilities at the CBD;

5) To make physical planning proposals for the adequate and orderly provision of parking facilities at the CBD.

1.4 SCOPE AND LIMITATIONS:

The study covers the aspects listed under Section 1.1 above. The field measuremants are undertaken within the Kaduna CBD, as defined by the Kaduna State Urban Planning and Environmental Protection Authority (KADUPEPA). The analysis of parking demand, however, is limited to the aggregate level taken on the basis of the various landuse sectors of the CBD. That is, it does not include the analysis at the individual property level, without loosing the essence of the exercise for planning purposes.

1.5 METHODOLOGY OF FIELD STUDY:

The primary source of data for the study is field measurement. The Cordon Count Method is used to obtain data on parking accumulation at the different sectors of the CBD. This involved identifying the primary roads that connect the CBD to other parts of the town. Survey stations were then set at points of entry and exit for vehicles as they cross the cordon (CBD boundary). Two survey assistants at each station were involved in counting vehicles of various categories, as they enter or leave the CBD. Figure 1 shows the study area and survey stations.

The Direct Interview Method was used to collect information on the motorists' destination within the CBD, purpose of visit, parking preferences, parking problems regularly encountered, etc. These were conducted by one of the assistants at the stations, using formated interview schedules and based on a 1% systematic sampling system.

The Patrol Survey Method was also used to obtain information on the characteristics of parking facilities, parking duration, usage of the facilities, etc, in the different sectors of the CBD.

The surveys were conducted from 6am to 8pm in order to capture traffic associated with the CBD activities, including those in the evening like recreation and entertainment within the CBD. The field study lasted for seven days in October, 1992. That is, the peculiarities of normal work days and week-ends are adequately taken.

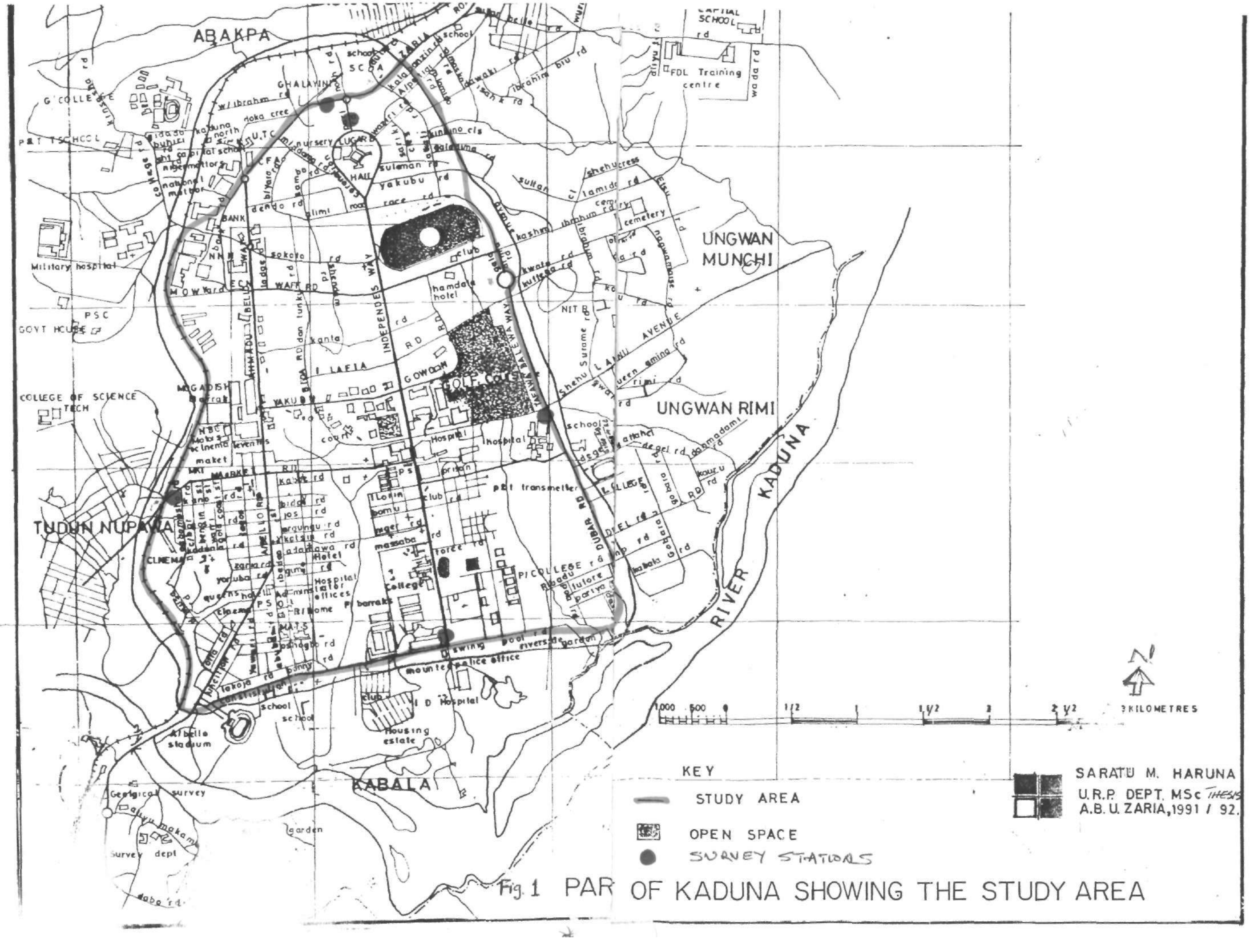


Fig. 1 PART OF KADUNA SHOWING THE STUDY AREA

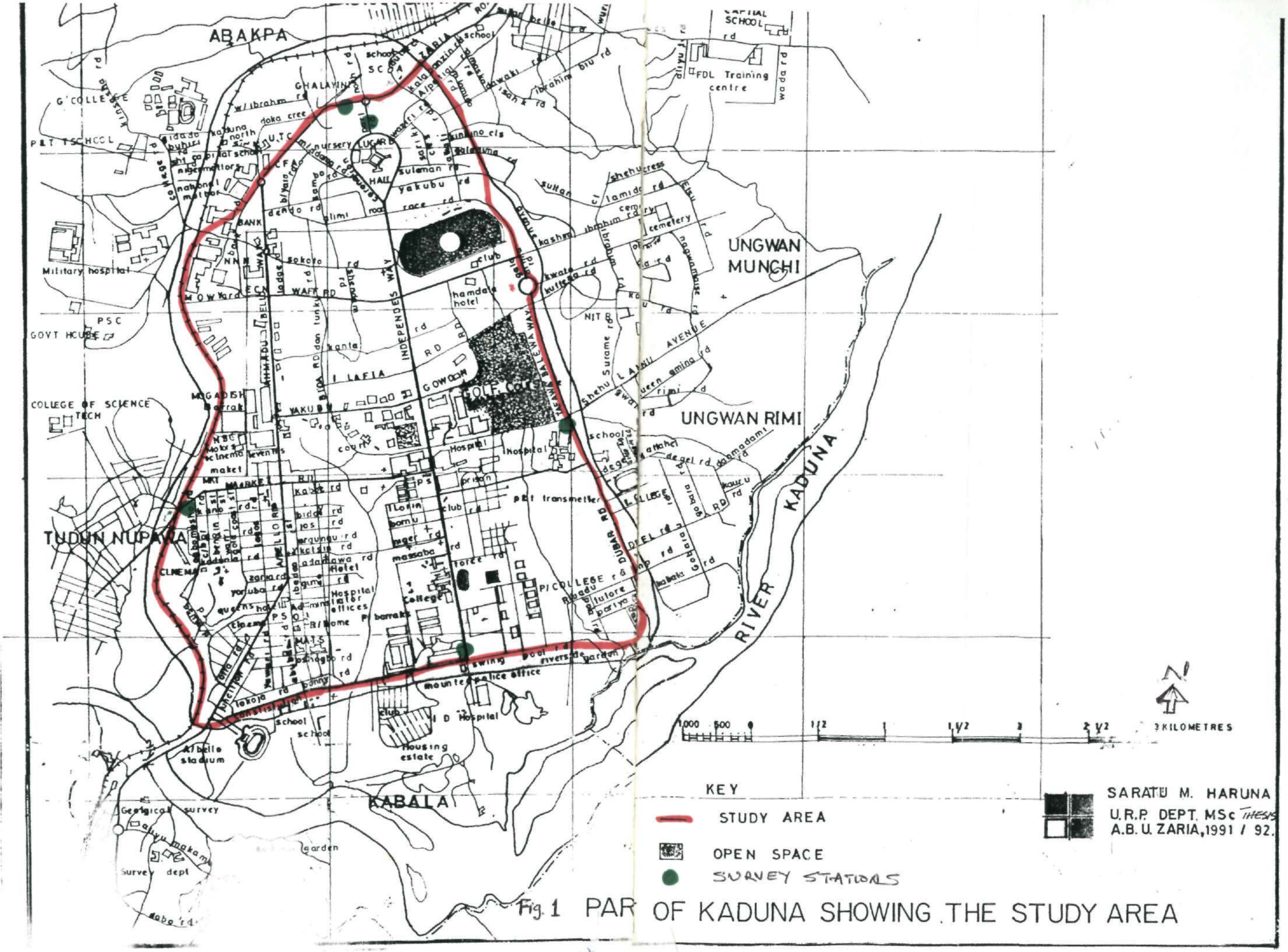


Fig. 1 PAR OF KADUNA SHOWING THE STUDY AREA

Various statistical methods were used for the data analysis. The results are presented as graphs and tables. Inferences drawn form the basis for the explanations and conclusions drawn in the study. Secondary sources of data were also used. They include documents and maps as well as informal interview of government officials.

1.6 THE STUDY AREA:

1.6.1 Location:

Kaduna town is located between latitude 10oN and longitude 7o 27'E. It is within the geographic centre of the northern parts of Nigeria (see fig.2). It is also well connected to other parts of the country by road, air and rail transport routes.

1.6.2 Growth of Kaduna:

Kaduna was designated as a regional headquarters for the defunct Northern Region by the Colonial Government. It retained this administrative status until 1967 when it became the capital of the North Central State of independent Nigeria. It was retained as the capital of Kaduna State in 1987 when Katsina State was excised from it. Owing to its history as an administrative centre, Kaduna has experienced tremendous growth. Like Kano and Jos, Kaduna has grown into a commercial and industrial centre in the northern parts of Nigeria.

Kaduna has also had a high rate of population growth. In 1952, it had a population of about 40,000. This grew sharply to about 149,910 according to the 1963 census. The population was estimated to be about 350,000 in 1983 (Kulshrestha, et al, 1984). At this rate, the population is estimated to be 560,000 in 1992. This is taken as the Kaduna office of the National Population

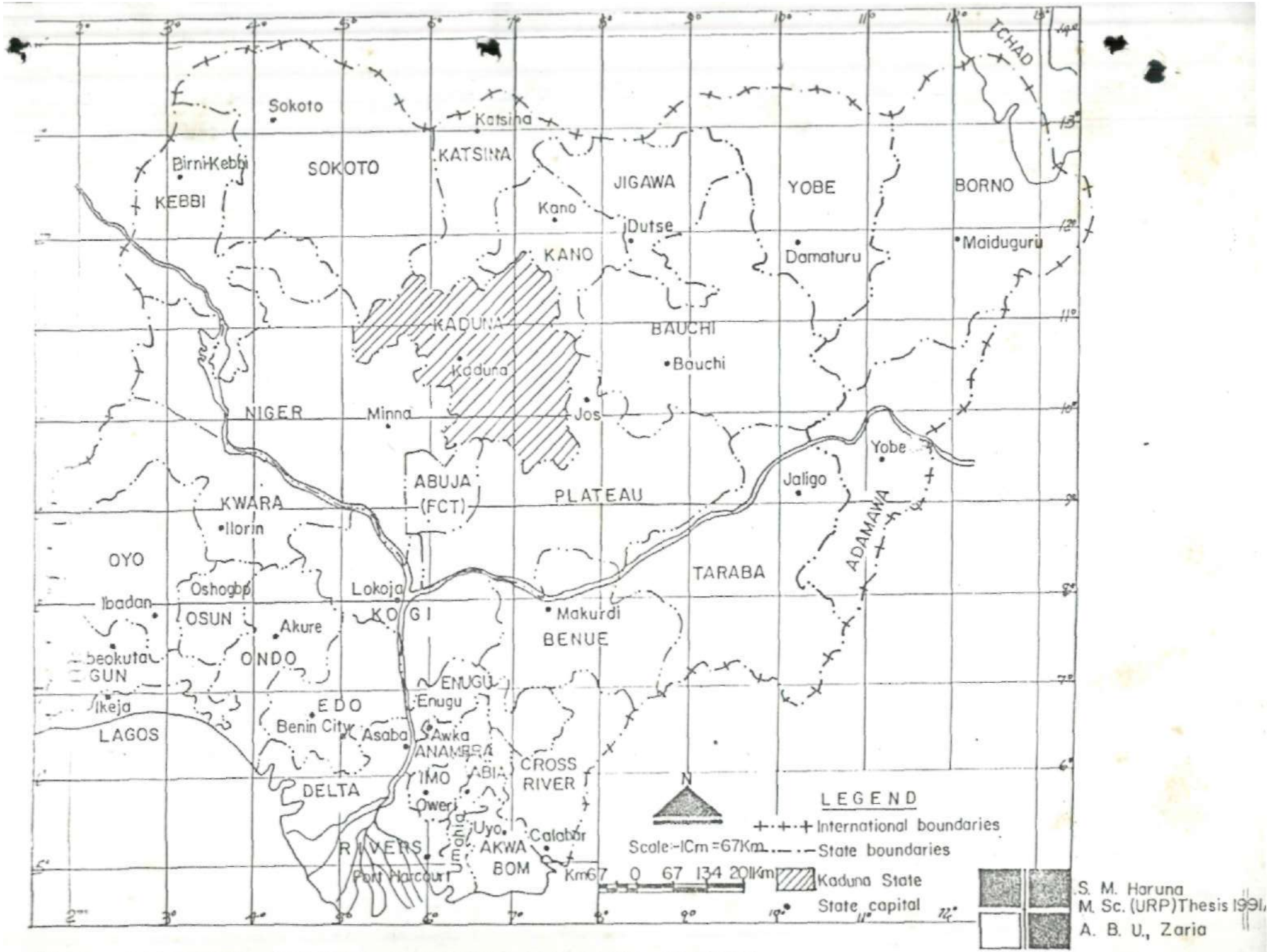


Fig. 2 MAP OF NIGERIA SHOWING KADUNA STATE

Commission would not give the 1991 census figures in view of its legal position.

1.6.3 The Kaduna Central Business District:

Various alternative terms and definitions of the Central Business District have been offered. For instance, terms such as Central Area, Core Area, Down Town, etc, have been used. It has been defined as that part of the town in which are found the central services of the highest order that can be supported by a town of particular category and type (Keeble, 1969). It has also been defined as the chief administrative, business, entertainment and cultural centre of the town as a whole (Gibberd, 1953). While Keeble's definition lays emphasis on profit-motivated activities like commerce and services, Gibberd's definition includes non-profit activities like administrative and cultural activities. It is clear though that the CBD is not simply its geographical centre; rather, it is the place to which the public responds spontaneously on occasions of greatest urgency or need (Wingo, L. Jr, 1963). In traditional Nigerian cities, the centre is the focal point of socio-cultural, economic and spiritual activities. That is, the CBD consists of the highest concentration of commercial, civic and mixed residential cum commercial uses.

According to Juchnowicz, 1978, the characteristics of modern city centres include compactness of development, high land values, high employment densities, concentration of retail trade, heavy traffic volume, high parking index, etc.

The term Central Business District (CBD) is used in this study; and given the concensus on its characteristics, the parking problems of Kaduna are indeed to be found within its CBD.

For the purpose of this study, the CBD of Kaduna is taken as that defined by Kaduna State Urban Planning and Environmental Protection Authority (KASUPEPA). Although not explicitly indicated anywhere, KASUPEPA appears to have used the Break in Continuity technique in delineating Kaduna CBD. It is found to be adequate as the critical issue in this study is the inclusion of areas of concentration of central area functions rather than the precision of boundary delineation. It is there that parking problems are pronounced. The selection and use of other techniques like Central Business Intensity Index, the Frontage Intensity Index, Multivariate Analysis (Murphy and Vance, 1954; F. Stuart and S.F Weiss, 1960) are therefore not necessary.

The adopted Kaduna CBD boundary (see fig 1) spans over a total area of about 508.9m2. To the north, it is bounded by the Lugard Hall round about, and the Ahmadu Bello Stadium to the south. To the east, it is bounded by Tafawa Balewa Way, and the railway line to the west. The landuse content of the CBD is shown in Table 1 below.

Table 1: Kaduna CBD: Landuse Content.

Landuse Categories	Area Covered (Ha)	% of Area
Residential	198	38.20
Commercial	87	17.20
Public/Semi-public:		
Armed Forces	64	12.7
Others	81	15.9
Open spaces	48	9.6
Vacant	30	6.4
Total	508	100.0

Source: Reviewed Master Plan (Kulshrestha, et al, 1984)

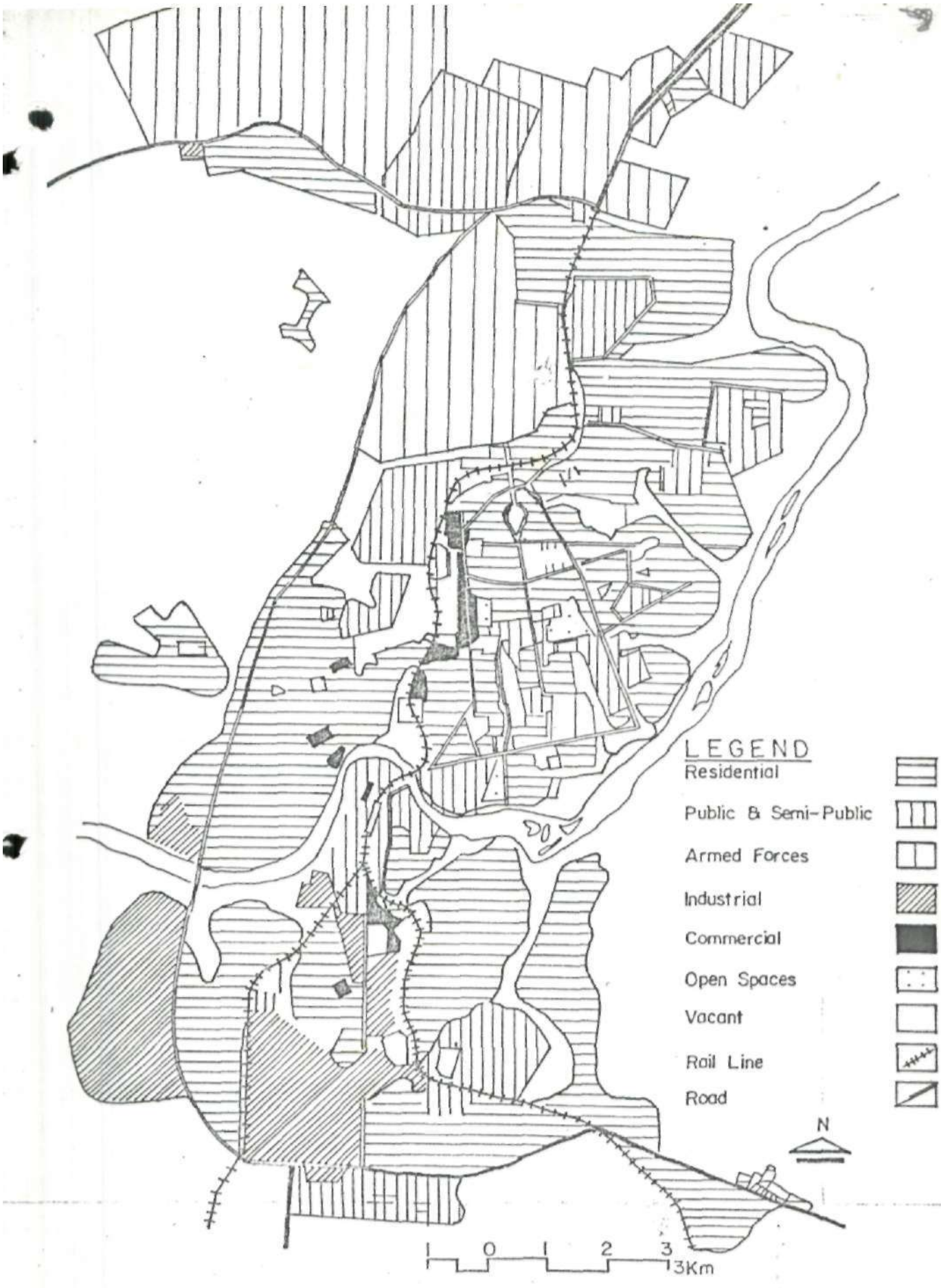


Fig. 2b: EXISTING LAND USE IN KADUNA

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1.6.4 Landuse Structure of Kaduna CBD:

The details of the characteristics of parking demand and supply within the CBD of Kaduna is discussed within the framework of its landuse structure. This section therefore analyses the city centre landuse structure.

Analysis of the structure of landuse in the Kaduna CBD reveals that there are four sectors of distinct landuse concentrations (see Fig.3). The sectors are as follows:

Sector One is the area around Ahmadu Bello Way. It is predominantly a business and civic activity area. About 80% of these activities in the CBD are found in this sector.

Sector Two is the area around the central market stretching from Broadcasting Road to Katsina Road. It is basically the commercial area where 90% of the shopping is done in the CBD.

Sector Three is predominantly that of public uses. It stretches from Hospital Road southwards to Constitution Road. It is in this sector that about 80% of Government offices and workplaces in the Kaduna CBD are located.

Sector Four stretches from Court Street to the northern boundary of the CBD. A few workplaces, recreational uses such as Hamdala and Durbar hotels as well as residential landuses characterise the sector.

1.7 THE PARAMETERS OF PARKING:

The parameters of parking considered in the study include parking accumulation, parking duration, parking volume and parking index. First, parking accumulation refers to the number

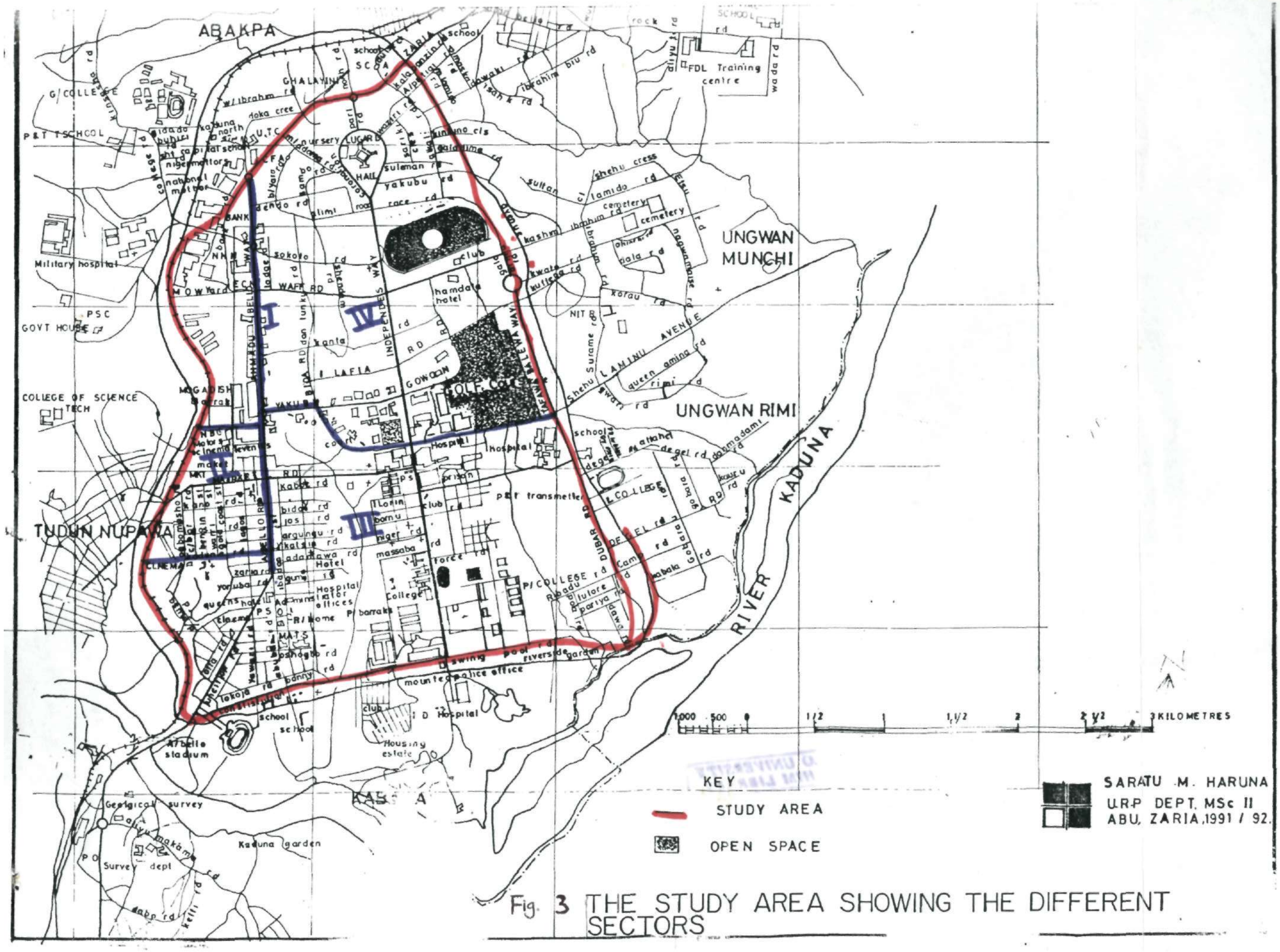


Fig. 3 THE STUDY AREA SHOWING THE DIFFERENT SECTORS

of parked vehicles or vehicles needing to be parked at a specified area at a specific time period. It is expressed as vehicles per specified time period.

Second, parking duration is the period, in minutes or hours, that a vehicle is parked in a specified area. The average parking duration in an area would be the average time period for all vehicles parked in an area, within a specified time cell, usually day. Also, in general the parking duration is higher for work trips. Parking duration is also less for on-street parking than that of off-street parking.

Third, parking volume is the total number of vehicles parked in a parking area within a time period, usually a day. That is, work areas have lower parking volumes as the parking capacity is often largely taken up by long-term parkers.

Fourth, parking index is a measure of the intensity of use of parking spaces. It is expressed in percentage of the theoretically available parking spaces.

1.8 SUMMARY:

This chapter has set out the design of the research. In the next chapter, the concept, determinants and methods of measuring parking demand are reviewed. In addition, parking supply and its determinants are discussed. The object is to provide a sufficient basis for understanding the theoretical context of the work as well as the tools for the field measurements in the study.

CHAPTER TWO: PARKING DEMAND AND SUPPLY: A Review of Concepts and Methods.

2.1 PARKING DEMAND AND SUPPLY:

2.1.1 Concept of Parking:

Human activities involve, among other things, the movement of people and goods. When the means of transport are not in use, they are parked. That is, parking is the temporary storage of vehicles between trips or at the end of trips (Abram, 1971). There are two basic types of parking: off-street and on-street parking. For urban road transport, off-street parking is storage of vehicles in garages, drive-ways, or lots specially set aside for idle vehicles.

2.1.2 Concept of Parking Demand:

The demand for parking is the expressed need by motorists for facilities to store vehicles on a temporary basis. The demand is a derived demand because it arises from the need for journeys for various purposes. Parking demand is therefore directly affected by landuse. Also, it has a time framework. First, parking may either be short-term when vehicles are parked for only a few minutes as 10 - 15 minutes, or long-term when they are parked for many hours in the day. Second, for any particular area, the demand for parking may vary at different times of the day in terms of the collective need expressed by motorists.

Parking demand has spatial dimensions as it varies from one part of the town to another, being generally higher at the CBD and other commercial areas compared to residential areas. is, the major activity areas of the town which attract a high volume of traffic, have higher parking demand. Additionally, the demand

for parking is effective if it is backed by the ability to pay in money terms where it is charged. It may also be in terms of motorists' willigness to take the risk of parking their vehicles at a parking area.

2.1.3 Determinants of Parking Demand:

Several factors affect the demand for parking facilities. There are those with a direct effect while others exert an indirect effect on parking demand. The direct determinants include, first, landuse. Different landuses attract different levels of traffic and to some extent different types of vehicles. This places different parking demand situations for different landuses in the city. Commercial landuses like banks, markets department stores, etc, are known to attract more visitors than other landuses especially, at peak hours. Therefore, the demand for parking is expected to be higher in the CBD of Kaduna (see fig 2), particularly some sectors of the CBD which have concentration of commercial, public and semi-public uses. Public uses like government offices, institutions, etc, are also places that attract large number of visitors and therefore a high level of parking demand.

Second, urban activity patterns change with time. That is, time of day is a determinant of the level of parking demand. For instance for areas with a concentration of public uses, the demand is higher during hours of work on weekdays while the nights record negligible levels of parking demand. Similar situations occur in traditional urban markets which have fixed daily closing times.

Third, vehicle usage affects the level of parking demand in a city. It refers to the mileage covered by vehicles in a town. It has been established that the higher the rate of vehicle usage, that is, the more often vehicle owners use their vehicles, the higher will be the demand for parking facilities. Each time a trip is made, vehicle owners have to park at any intervening and terminal destinations.

Fourth, the type of vehicles that are most dominant in a city (or part of a city) affects parking demand in terms of the space requirement which is smaller for cycles and larger for trucks. Where there is a poor mass transit system, as in most Nigerian urban centres including Kaduna, the use of private vehicles will be higher leading to higher demand for parking facilities.

Fifth, the rate of parking demand is affected by the rate of vehicular ownership. It has been established that the higher the rate of vehicle ownership, the higher the rate of demand for parking facilities; that is, given equal vehicle usage.

The factors which indirectly affect the rate of parking demand include, first, the parking policy as it relates to charges for parking as well as other controls often introduced to improve traffic management especially in the CBD. This is because as city size increases land values rise and consequently parking has to be charged for or even restricted in parts of the CBD. In some cities of the More Developed Countries where this policy has been applied, it has led to constraint on the rate of parking demand in those areas.

Second; population growth. Increase in a town's population leads to rise in parking demand as more trips and trip makers result from population increase. This is even more so when population increase goes with a third factor, viz, increase in income. The later, especially when it is widely distributed, leads to rising vehicule ownership. This in turn leads to rising parking demand. In Nigeria, for example, the rise in income especially during the oil boom period and the public sector vehicles loan policy, lead to increase in vehicular ownership. This has been associated with the high demand for parking facilities especially in the larger towns with higher income base.

2.1.4 Concept of Parking Supply:

Parking supply is the provision of facilities for the temporary storage of vehicles. The type and level of availability and location of the parking facilities should be on a planned basis so that it is adequately related to factors such as the demand, landuse policy and economics of land in any urban centre.

All or some of the following facilities may be associated with planned parking. These are covered garages, paved or unpaved spaces, marked lots, security units, shade trees, and coin boxes. On-street parking is storage at kerbs on road Right of Ways. Parking shed and shade trees provide protection for vehicles from the sun, rain or snow which have destructive effect on vehicles and cause discomfort to motorists. They also protect against vehicle breakage from children's play or even against vehicle theft. Security facilities (offices and staff), are a necessary feature of vehicle parks for safety reasons. Also, revenue

offices or revenue collection facilities like coin boxes are required in some parks where fees are charged for parking as in developed countries.

There are standards that are used to determine the space requirement for different urban landuses as well as standards for parking spaces and lot sizes. For example, in a developed country like Britain where two out of every five families have cars, the following standards are widely used. For residential areas, the standard is one parking lot per dwelling. For offices and banks, one lot for every 35m² of gross floor space. For shops and industrial establishments, it is one lot per 50m² of gross floor space. And, for uses such as hotels, hospitals and restaurants, it is one parking lot per three and twelve bedrooms, respectively and one parking lot per 10 seats for restaurants (Keeble, 1969) .

2.1.5 Determinants of Supply for Parking:

Data is required to ensure planned physical growth and development of towns. One aspect of this is data to make correct estimates of parking demand, location and type of parking facilities that may be provided. In Nigerian urban centres including Kaduna these data are lacking; so the limited planning for parking and the supply of the parking facilities are done arbitrarily. The aspects of data required include the number of trip makers to the CBD for different purposes, the level of supply and use of the existing parking facilities.

Another determinant is land value. The provision of parking facilities involves the acquisition and use of land. City centres like that of Kaduna are areas of high land values. Since parking

is not a profit-yielding activity and therefore does not bring direct economic returns, even if fees are charged, the restriction on its demand on land in the CBD is indeed a determinant of supply of parking facilities.

Availability of finance is also a determinant of the supply of parking facilities. Funds to provide parking facilities such as underground, roof-top or mechanised garages are not readily available. Spending on parking is generally not considered economiclly acceptable as it is not a profitable venture for both the public and private sectors. Only in an indirect way is it considered important for the private commercial sector. For example it gives the convenience that attracts trip makers. Also, it is only seen as a service as it is related to the solution of urban transport problems although it promotes economic activity and produces cuts in costs of urban activities. In the Less Developed Countries (LDCs) where the relationships are not understood or other political priorities are taken, it largely accounts for the deficiency of parking facilities.

2.2 DEVELOPMENT OF PARKING FACILITIES:

At the turn of the century, motorised transport was owned by few wealthy people, corporate bodies and Government. Owing to the small number of vehicles, there was no significant demand level for formal designated parks. Vehicle owners simply parked in undesignated spaces either in front of their homes or work places. With growing vehicular ownership and commercial transport, the need to provide specially designated parks was recognised. Furthermore, there was the introduction of landuse planning and the development of specialised areas like offices,

recreational centres, commercial, residential and industrial areas. These necessitated the provision of parking facilities.

The development of integrated transport systems has also made it necessary for parking facilities to be provided especially at points of interchange. Regional transport networks have also led to the development of regional stop byes and parks like those found along Mando and Television village in Kaduna town.

The parking problems of cities like Kaduna is not simply due to the increasing number of vehicles in use but also that demand for parking piles up in certain time periods and at certain locations making it necessary to have municipal garage systems. Apartments and institutions are expected to provide 100% off-street parking. However, the present notion on parking is that the provision of 100% off-street parking facilities attract additional traffic as it encourages the use of the private car. The solution could be the improvement and extension of the mass transit system and provision of large garages at the periphery of cities.

To be able to choose the correct method(s) as well as formulate policies for the purpose of ensuring the development of parking facilities in a city like Kaduna, it is necessary to have a satisfactory estimate of the demand for parking. This requires the use of an appropriate method for determining parking demand and to project for a given period of time.

2.3 METHODS OF MEASURING PARKING DEMAND:

Several methods have been formulated for determining the demand for parking as a basis for providing adequate parking

spaces in a city. These are parking surveys, use of standards, and use of vehicle ownership data.

2.3.1 Parking Survey:

The common survey techniques used in the measurement of parking demand include the following:

i) Cordon Count:

The method involves using a cordon line which delineates the study area. Counting stations are established at points on all roads that cross the line. At the stations, separate counts are made of various types of vehicles entering and leaving the study area. The difference between the number of vehicles entering and those leaving the area gives the accumulation of vehicles in the area. The accumulation is equivalent to the number of vehicles parked and needing to be parked in the study area. When the accumulation is related to the supply for parking existing in the area, the requirement of parking facilities is obtained.

There are various techniques of counting vehicles for this and other purposes. They include the use of automatic counting devices and manual counting.

ii) Direct Interview:

For the purpose of obtaining data which enrich the quantitative measure of accumulation, the direct interview is also used in the survey. This involves stoping a sample of motorists and questioning them about their purpose of trip, their parking problems and preferences, etc. This way, the share of accumulation taken by different activity areas within the study

area, and the particular problems of parking can be determined. These are indeed aspects of parking demand.

iii) Patrol Survey:

In this technique of parking survey to determine demand, the study area is divided into manageable sections that can be covered by interviewers in reasonable time intervals like 30minutes, one hour, etc. Interviewers are given specific street stretches to keep under surveillance and the number of parked vehicles in particular places are counted. Based on the time units taken for the survey, the number of parked vehicles per time cell may be computed. Statistics like the registrationn numbers, vehicle types, parking duration, form of parking, nature of parking whether legal or illegal, kerbside, off-street, etc, may be recorded. The qualitative characteristics of the parking facilities are also recorded by the surveyors on patrol.

For the results to be reliable, the sections should be such that kerbside patrols can be covered by the interviewer(s) walking to and fro in the stipulated time interval. Patrol in vehicles will however enable larger sections to be covered. This supports the computation of operating turnover of parking facilities, the characteristics of the existing facilities and their usage in various parts of the study area.

2.3.2 Use of Standards:

Studies that detail out existing situations at specific landuses in various urban contexts form the basis of deriving planning standards. The detail situation for parking, would involve deriving standards for different landuses. As for other

aspects of planning, the existing situation is set against the patterns of use of the parking facilities as observed over a reasonable period of time to rationalise the standards for operational purposes. This means that the parking standards may be used to estimate the level of parking demand when various facilities in an area (e.g. markets, banks, etc) are known as the specific requirements in the activity areas may be summed up to closely represent the level of parking demand in the study area. A plus or minus margin may be allowed to adjust for validity of standards being used, record of parking facilities in the area, etc.

The outcome of the computations would represent the parking demand only to the extent that the standards used are appropriate for the particular urban context. This is because standards are place specific. That is, using standards derived from the Developed Countries may may produce rather generous parking demand estimates and vice versa. Nevertheless the use of standards provides a fairly acceptable basis for determining parking demand as earlier explained.

2.3.3 Use of Vehicle Ownership Data:

Parking demand can also be determined by using records of ownership in an urban area. These records are often available from vehicle licensing offices. The records are only proxy of the true measure of vehicle population in a town, though in view of the fact of residential mobility of vehicle owners. Nevertheless the principle is that increase in vehicle ownership is directly associated with an increase in parking demand (see section 2.1.3). Details of vehicular ownership like class of people

3.1 EXISTING POLICIES ON PARKING IN KADUNA:

The choice of management strategy for parking follows from the determination of parking demand and the understanding of parking problems in a city. Parking management strategies are measures taken to alter the supply or cost of parking in order either reduce vehicle travel time into the CBD so as to reduce congestion and traffic delays or to make the operation of urban highway system more efficient. Most policies on pparking are geared towards the CBD first, before considering other sectors of the city in view of its importance in the overall urban economy. Most of the strategies used in parking control can only be effectiveiy used if basic traffic planning data are available. These include traffic volumes, number of parkers and parking lots, parking duration, travel time and delay, etc. Most of these data are lacking for many Nigeria cities including Kaduna.

Although some policies have been formulated for solving parking problems in Kaduna, most of them have not been implemented. First, the Planning Board responsible for the planned physical development of Kaduna directed that all storeyed buildings within the Central Area should have a plot development coverage of 45%. In granting planning permission, the Board is to ensure that the ground floor of such buildings are devoted to parking. There was also to be redevelopment plans for areas along Ahmadu Bello Way, Katsina Road, etc, for commercial purposes to be provided with adequate parking facilities.

Secondly, some vacant plots were to be acquired by Government some of which would be developed for parking. However, the policy has not been implemented to any significant extent. One of the few sites that were acquired has been leased out to Ikara Motors, private vehicle dealer.

Third; another policy led to the Kaduna Urban Renewal Project which was aimed at decongesting the CBD and provide for adequate parking. The area from Ibrahim Taiwo Road to Adamawa Road (most of which is made up of 'decaying' residential properties) was to be acquired and developed for commercial purposes to be sold to people. The alternative plan was to buy the dilapidated buildings, redevelop and relocate the displaced persons and the serviced plots sold to commercial establishments to develop.

Fourthly, the Mogadishu City Centre Project was initiated with the aim of reducing congestion and parking problems at the project site. The site design shows an attempt to provide for adequate parking. However, the project has not been implemented to any significant level.

Existing policies on parking in Kaduna are ad-hoc in nature. When workplaces like markets, banks, etc, are built, some space is usually reserved for staff and visitor's parking. This is not, however, done on the basis of a good understanding of the parking demand and appropriate standards.

In parts of the CBD where traffic congestion are recorded, traffic wardens and 'no parking' signs are used to restrict on-street parking without fundamentally solving the problem of parking. These include places along busy streets like Ahmadu

the aggregate level of the CBD.

3.2 PARKING ACCUMULATION IN KADUNA CBD:

This section discusses the aggregate characteristics of parking demand and supply at the CBD level and the details within the different sections of the CBD.

3.2.1 Parking Accumulation at CBD Level:

As explained in Chapter One, five stations were chosen along the cordon line defining the CBD and Cordon Count method was used to record the number and type of vehicles going in and out of the study area.

The count at the station along Ahmadu Bello Way near Lugard Hall round about shows a high incidence of all types of vehicles entring and leaving the station. The accumulation, that is the difference between in-coming and out-going vehicles at the station was an average of 1,826 vehicles per hour on weekdays with slightly lower average figure of 1,262 vehicles per hour on week-ends.

A second station is along Ibrahim Taiwo Road. There, average difference between in-coming and out-going vehicles is 750 vehicles per hour. There is a high incidence of all vehicle types. The high incidence of pick-up trucks and delivery vans is attributed to the central market where goods are delivered.

The third station is along Independence Way near the Police College. The cordon count at this station shows an average peak hour accumulation as 955 vehicles.

At the fourth station, along Tafawa Balewa road, the average accumulation is 1200 vehicles per hour. The station is well connected to some busy streets like Yakubu Gowon Way.

The fifth station is along Coronation Road near Lugard Hall. The difference between incoming and out-going vehicles is 917 per hour. A high incidence of private passenger cars (taxi) were recorded at this station. This related to the fact that many commuters to this part of the CBD are employees in the formal sector of the economy.

The average accumulation figures are given in Table 2 below. When the hourly accumulation figures at the stations are plotted the graph reveals a steady rise and a slight peak at about 10:00 am. An afternoon peak is revealed at about 2:00 pm and an evening peak at about 4:00 pm. For stations like those along Independence Way and Tafawa Balewa Way, the figures show that there are evening peak accumulation at about 6-8 pm. This is largely explained by the existence, in these areas, of recreational facilities.

Table 2 Kaduna CBD: Average Accumulation at the Survey Stations.

Station	Average Accumulation (vehicles/hour)	Percentage of hourly accumulation
Ahmadu Bello Way	1826	32.4
Ibrahim Taiwo Rd	750	13.3
Independence Way	945	16.8
Tafawa Balewa Rd	1200	21.3
Coronation Street	917	16.2
	5638	100.0

Source: Field Survey, 1992.

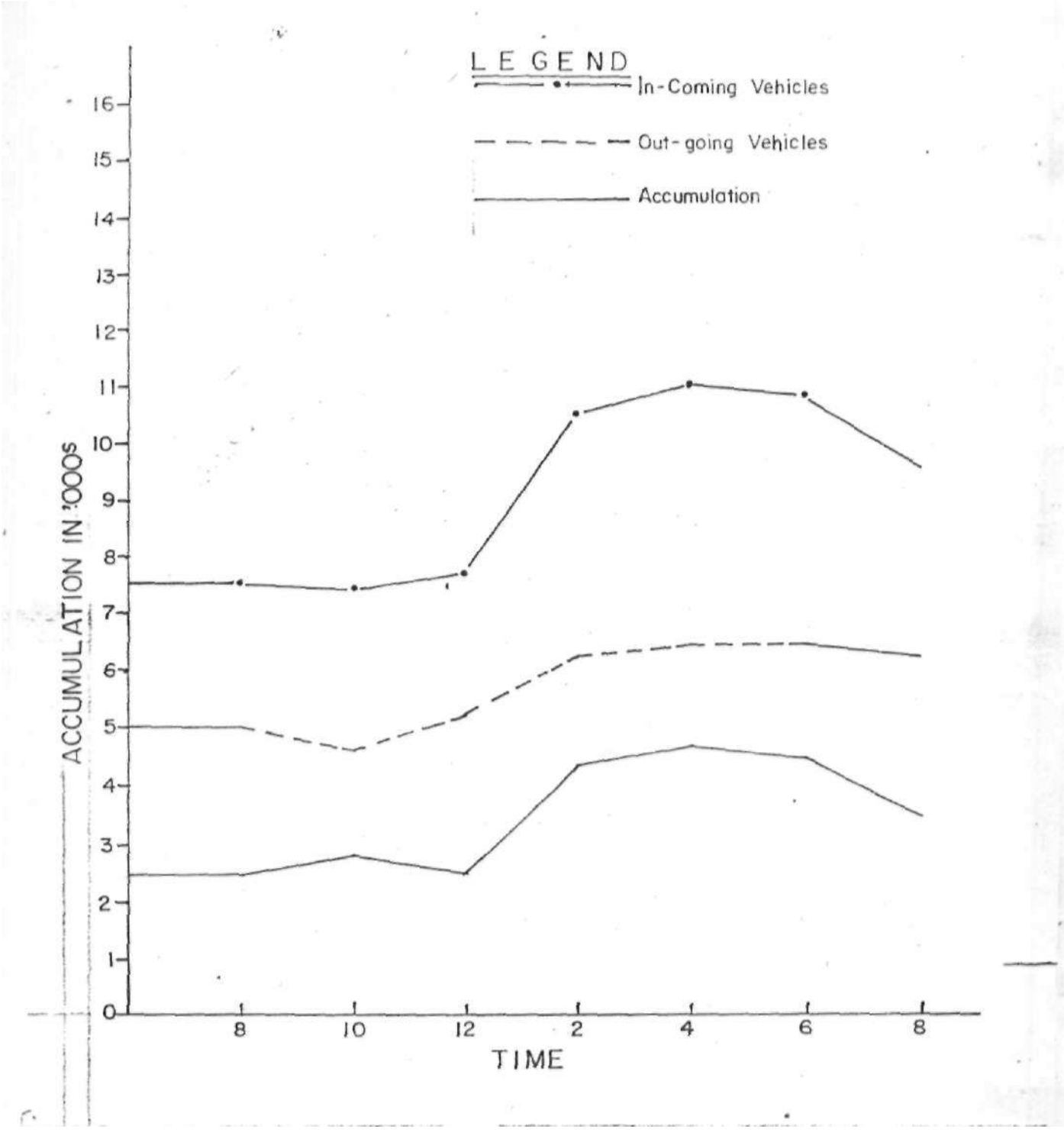


Fig. 4: SUM ACCUMULATION FOR CBD MONDAY 12/10/92

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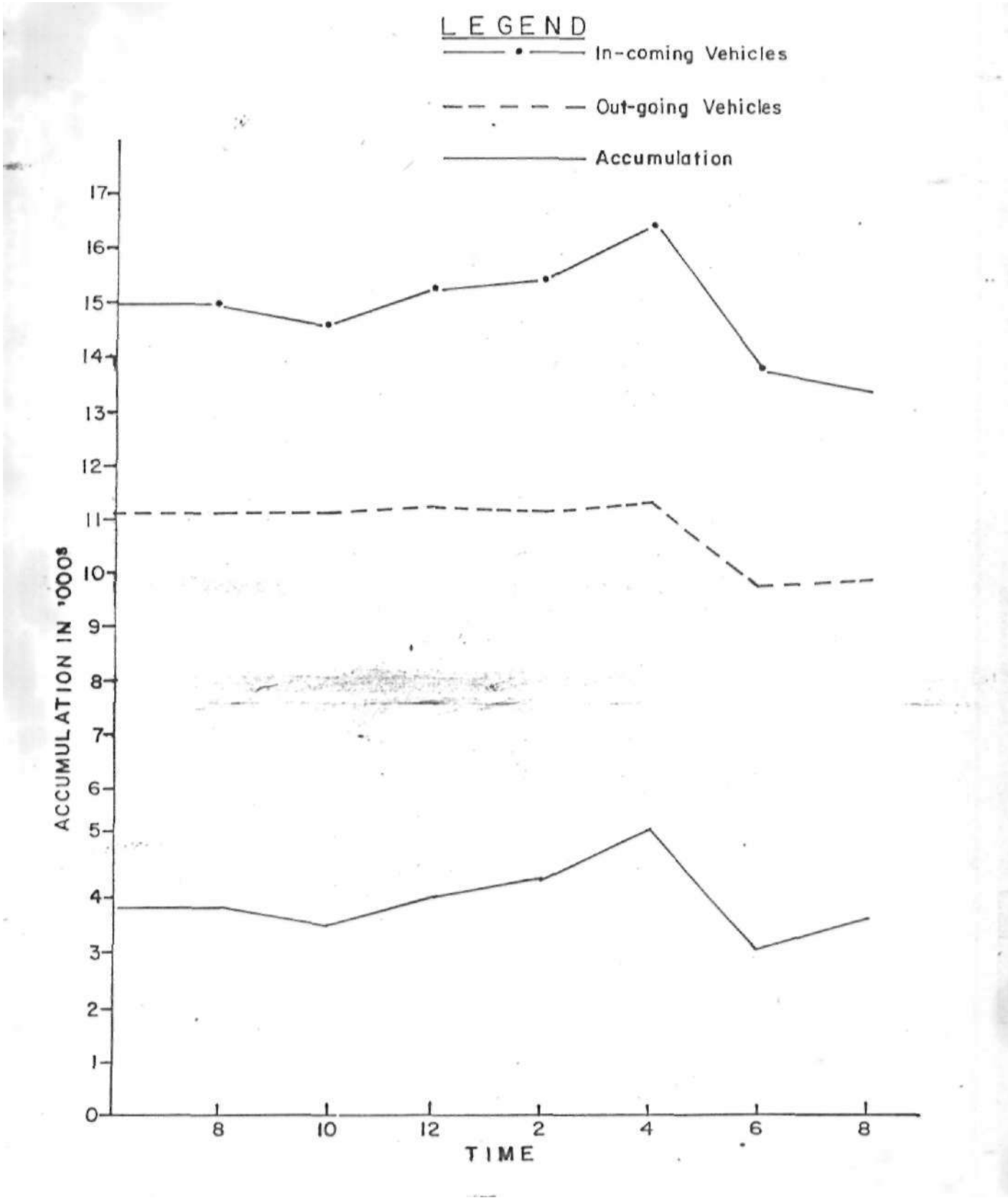


Fig. 5: SUM ACCUMUTION FOR CBD TUESDAY 13/10/92

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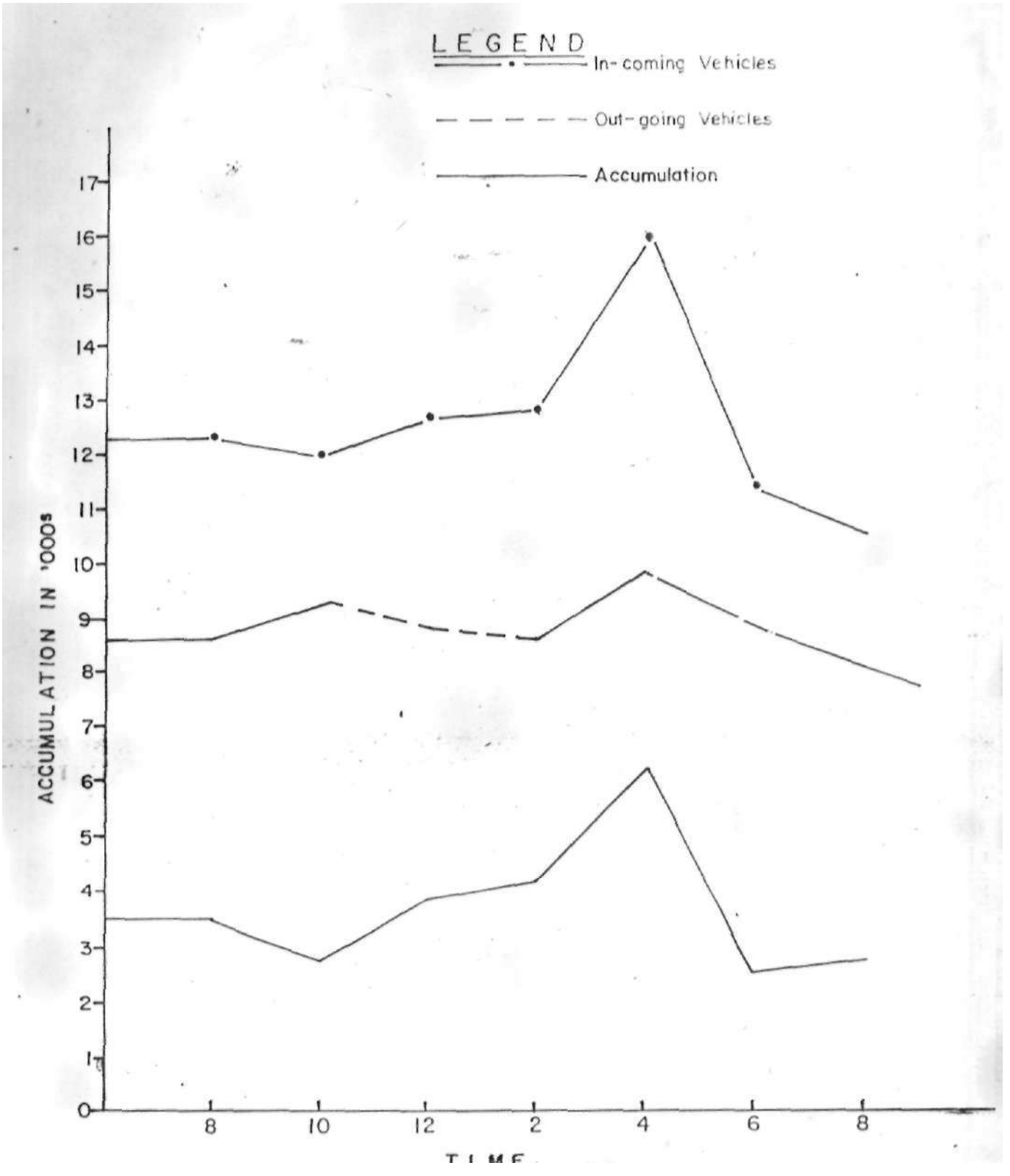


Fig. 6: SUN ACCUMULATION FOR CBD WEDNESDAY 14/10/92.

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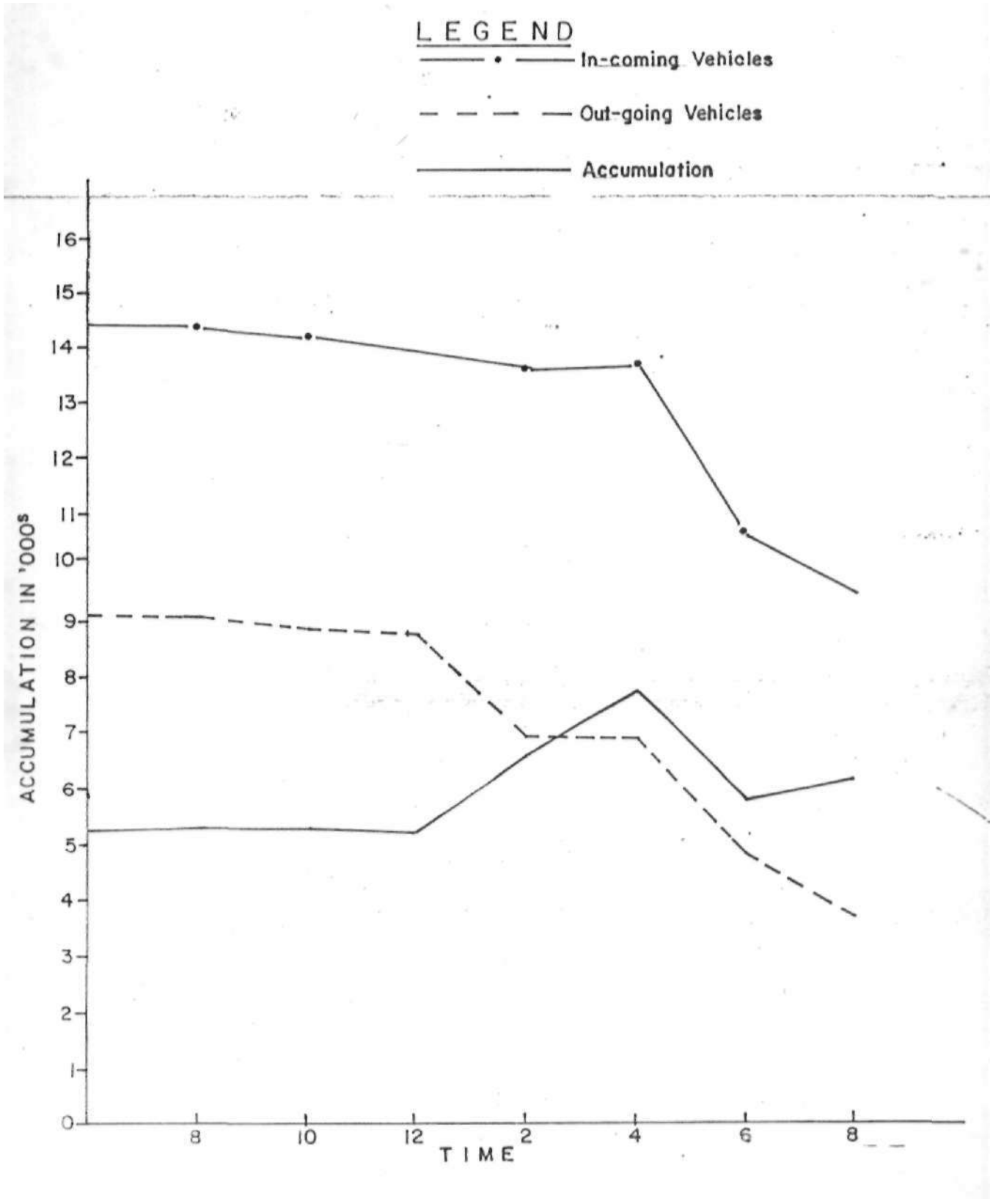
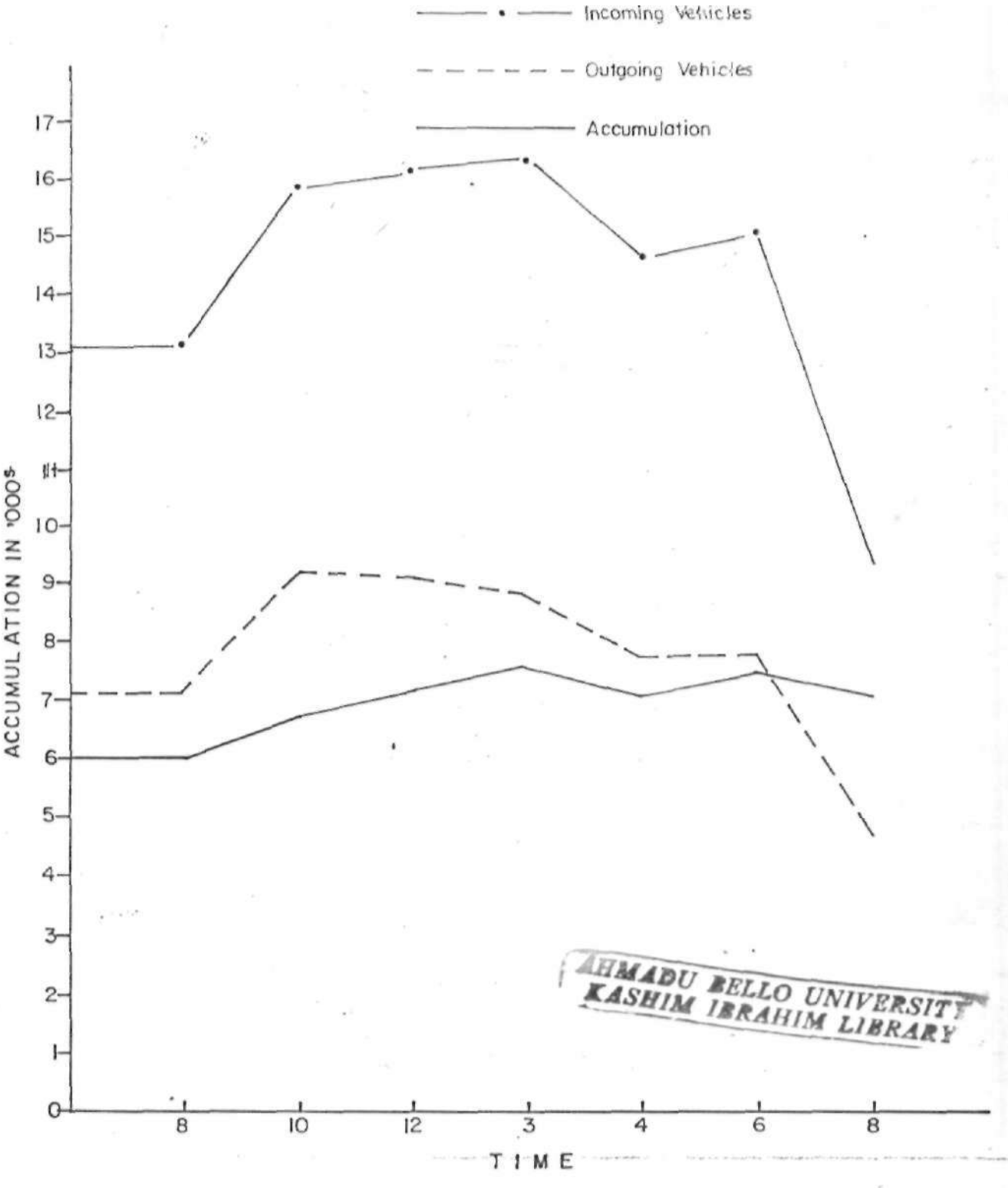


Fig. 7: SUM ACCUMULATION FOR CBD THURSDAY 15/10/92

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Fig. 8: SUM ACCUMULATION FOR CBD FRIDAY 16/10/92

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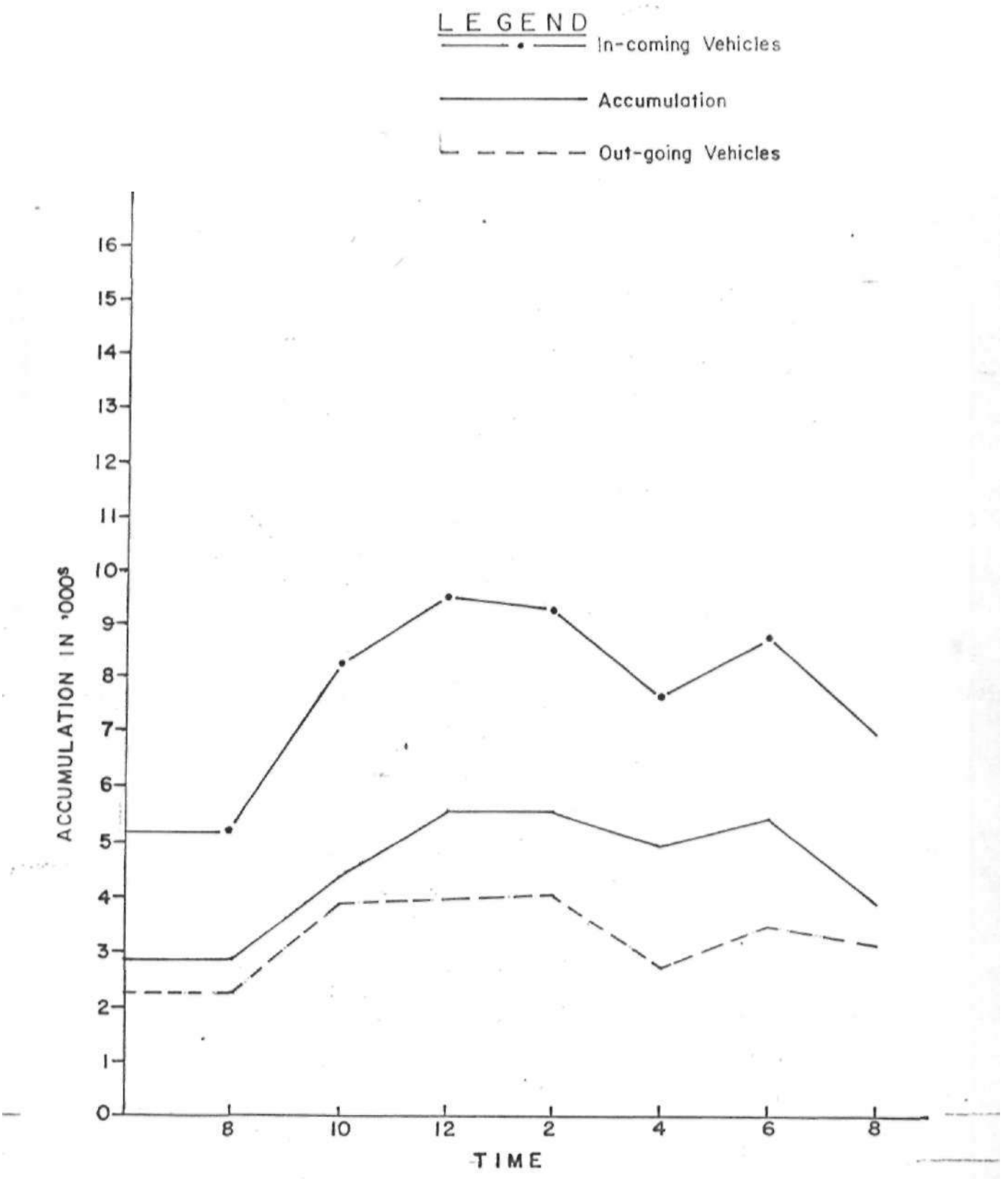


Fig. 9: SUM ACCUMULATION FOR CBD SATURDAY 17/10/92

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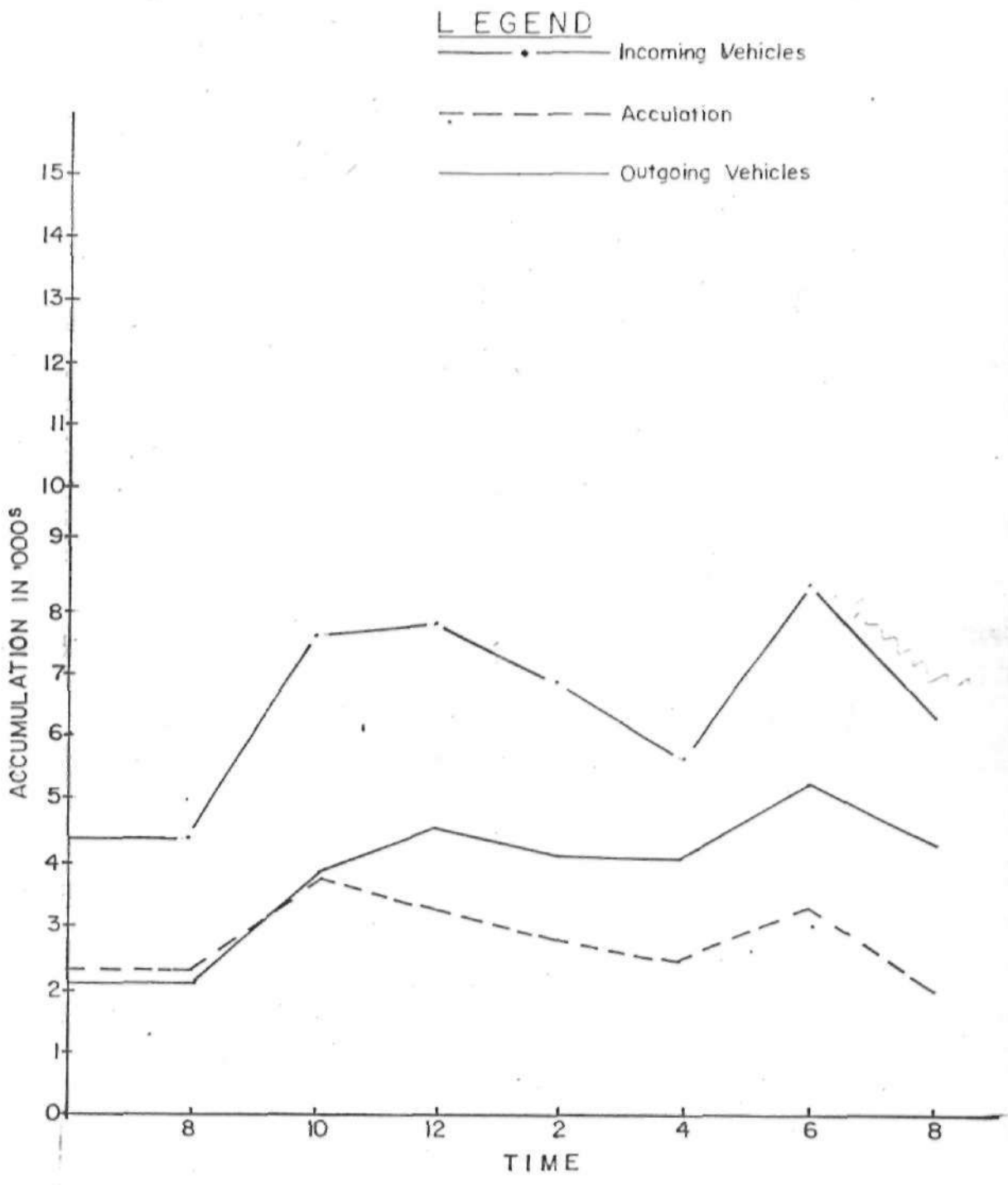


Fig 10: SUM ACCUMULATION FOR CBD SUNDAY 18/10/92

The accumulation at the various stations were summed up for the different days of the week as shown in Figures 4 to 10. They show similar characteristics as at the various stations with accumulation running at a higher level than out-giong vehicles during most times at the weekend. They also show high accumulation figures throughout the weekadys. This is evidenced by the high incidence of on-street parking as there are limited off-street parking facilities.

Again the average daily accumulation for the weekday was plotted (see Figure 11). It shows similar features as for most days of the week in terms of having two basic peak periods, the mornnig and afternoon; and the high peak hour accumulation. This underlies the fact of the concentration of vehicles within the city centre compared with the other sectors of the city. The presence of chaotic nature of parking, high incidence of car theft, etc are indicative of the limited capacity of existing parking facilities to meet the demand at the centre.

3.2.2 Accumulation in the CBD Sectors:

Two things are used for the detail of parking demand and supply characteristics within the CBD of Kaduna. First, is the purposes of trips within the CBD. That is used to determine the share of aggregate accumulation which is expected to go to different parts of the CBD which have different supply levels of parking facilities. Second, is landuse structure of the CBD because trips are attracted to, or emanate from different landuses at varying degrees. The later was discussed in Chapter One (see Section 1.5.3). The former is discussed below.

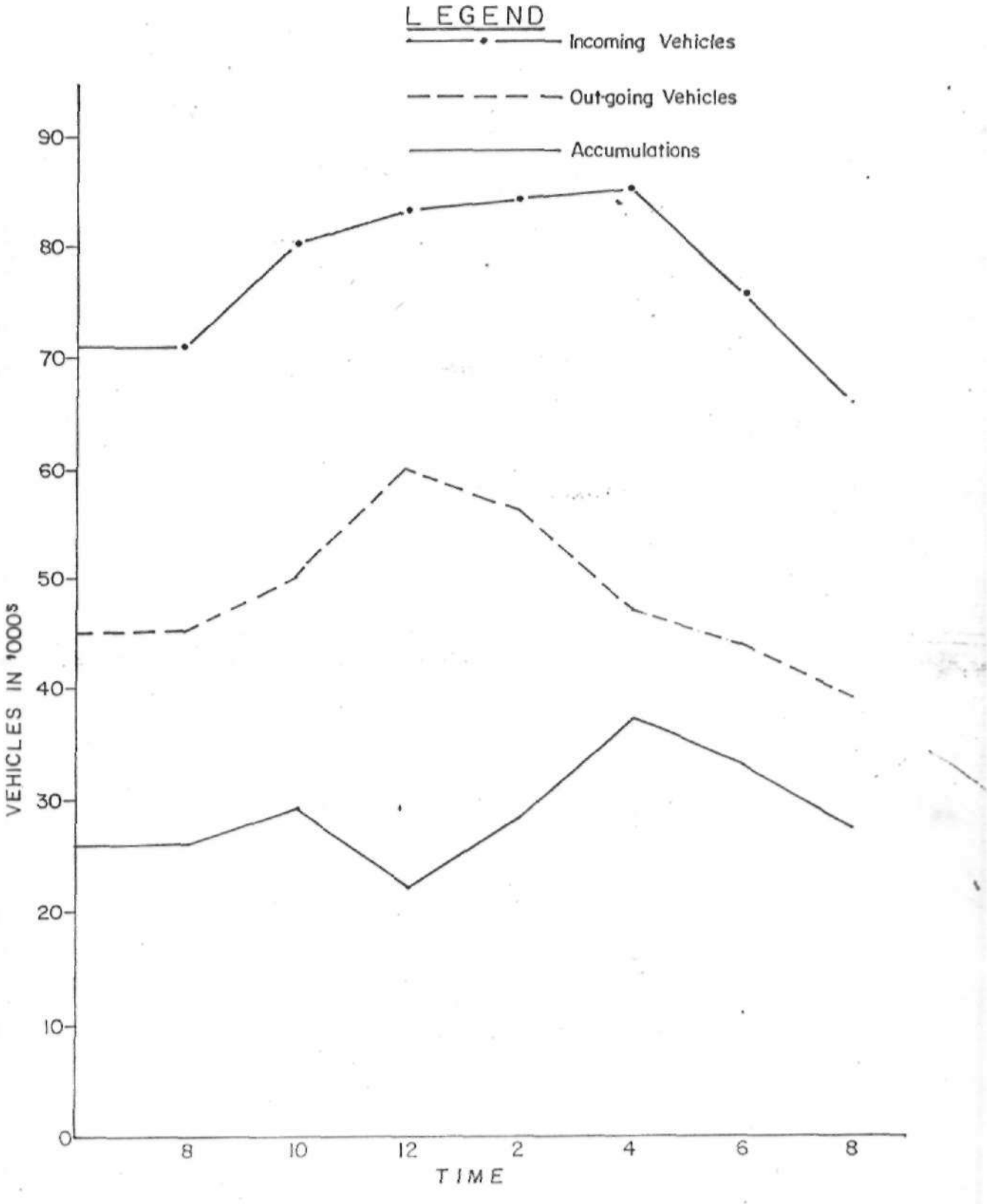


Fig 11: AVERAGE TOTAL ACCUMULATION FOR CBD OF KADUNA

S. M. Haruna
M. Sc (URP) Thesis 1991/92
A. B. U, Zaria

Some 498 motorists were interviewed to know the purposes of their trips to the CBD. This was done at the survey stations. The results showed that 33% of the visitors come to the CBD of Kaduna for the purpose of business and civic activities. This is followed by workers with about 30 per cent. Shoppers represent twenty-seven per cent (27%) while other visits represent the remanining ten per cent (10%). These are shown in Table 3 below.

Table 3: Visits to Kaduna CBD By Purpose.

Purpose	Nos. of Motorists interviewed	% of total motorists
Business/Civic	165	33
Shopping	135	37
Work	149	30
Others	49	10
Total	498	100

Source: Fieldwork, 1992

Using the distinct sectoral feature of the landuse of Kaduna CBD, the parking accumulation figures, in section 3.1.1, are distributed within the area. This was based on the above data on different purposes of visits to the CBD assuming that each purpose of visit points to the sector of the CBD to which the people would demand parking facilities. That is, depending on the dominant landuse in a sector, the number of motorists making visits for various purposes is computed into the share of accumulation expected within the sectors to which the visits are related. Thus, business/civic visits are assigned to Sector One. The shopping visits are assigned to Sector Two, the work visits to Sector Three and other visits are assigned to Sector Four.

Table 4 below shows the parking accumulation at the various sectors of the CBD.

Table 4: Kaduna CBD: Average Accumulation by the Various Sectors.

Sector	% of Motorists to CBD at the sector	Average weekday accumulation at sector (Nos. of vehicles)
1: Business/Civic	33.0	10906
2: Shopping area	27.0	8923
3: Work area	30.0	9915
4: Others	10.0	3305
	100.0	33050

Source: Field work, 1992.

The table reveals that Sector One has an average daily accumulation of 10,906 vehicles per day which is higher than for other sectors. It is followed by Sector Three, the work area, which has an average of 9915 vehicles per day. Sector Two is the shopping Sector with an average daily accumulation of 8923 vehicles per day and Sector Four has the least with an average of 3305 vehicles per day.

An aspect of parking in Kaduna CBD discussed next is the supply of parking facilities. This measures the extent to which the parking demand, expressed by the accumulation figures, are met.

3.3 SUPPLY OF PARKING FACILITIES IN KADUNA CBD:

Both quantitative and qualitative aspects of parking supply in Kaduna CBD are discussed in this section. The quantitative aspect relates to the number of parking lots provided and their location. The qualitative aspect covers the physical conditions

of the parking spaces in relation to the needs of safe and convenient parking.

3.3.1 Quantitative Aspects of the Parking Supply:

An inventory of the level of parking facilities in the CBD of Kaduna shows that there are about 6,319 parking lots in about 187 parking areas. An estimate of on-street parking is also made and included in the computation. Of this number of parking lots, about 3192, about 50% of the total, are for long-term parking. The remaining 3125, 49.5% of the total, are for short-term parking. The parking areas in the CBD cover an area of about 13.43 hectares.

Based on an inventory of parking facilities in the CBD according to the different CBD sectors it was identified that Sector One has a total 1382 parking lots which represents about 22% of the total parking lots in the CBD. Sector Two has about 948 parking lots or about 15% of the total. Sector Three has about 3168 parking lots or 50% of the total parking lots. The sector has a large number of organised parking spaces because it is a sector that has many Government institutions and offices. Sector Four has 819 parking lots or 13% of the total lots in the CBD of Kaduna.

3.3.2 Qualitative Aspects of the Parking Facilities:

The parking facilities identified in the Kaduna CBD were also examined in terms of their quality. The elements considered include the services supplied and suitability of the parking areas for vehicle storage. Three different categories of parking spaces were identified. First is the category taken as satisfactory where services are provided such as pavement,

marking or demarcating of the lots, sheds and shade trees, security posts. A total of 3192 parking lots or 50.5% of the lots in the CBD were found to be satisfactory. The fairly satisfactory are those that are not paved, marked, have inadequate sheds/shade trees, and no security posts. A total of 1753 parking lots or 27.8% belong to this category. Those categorised as not satisfactory are not paved, unmarked, no sheds/shade trees, and no security posts. About 1372 or 21.7% belong to this category.

The break down of these figures on the basis of the different sectors of the CBD is given in Table 5 below.

Table 5: Quality of Parking Facilities in Kaduna CBD by Sector.

Sector No.	Satisfactory		Fairly Satisfactory		Not Satisfactory	
	Lots No.	% *	Lots No.	% *	Lots No.	% *
1	427	30.9	492	35.7	463	33.5
2	146	15.4	214	22.6	588	62.0
3	2011	63.5	897	28.3	260	8.2
4	608	74.3	150	18.3	61	7.5
	3192	-	1753	-	1372	-

Source: Field work, 1992

The table shows that there are more parking areas in Sectors Three and Four with satisfactory and fairly satisfactory parking facilities. This is because the Sectors consist of institutional buildings and residential premises where organised parking is provided for workers and visitors. Also, the residential areas are low density developments with generous plot sizes, exclusive parking areas and landscaping.

Sectors One and Two have more acute shortage of parking facilities both in terms of quantity and quality. In particular, Sector One is dependent mainly on on-street parking. These Sectors constitute the core of the CBD where the congestion associated with commercial activities are found.

3.3.3 Parking Duration at the Kaduna CBD:

When vehicles arrive at the CBD are parked over a period of time. The parking duration in the CBD is discussed on two basic considerations. First is the durations officially regarded as short-term, medium and long-term parking. Second is the parking duration along selected streets which represent the average for different sectors of the CBD to which they belong.

Along Ahmadu Bello Way, a total of 498 parked vehicles were surveyed during one week and the data averaged out. The results are shown in Table 6. They show that most of the vehicles (over 96%) were parked on fairly short periods, that is between 10-59 minutes. Many of the motorists come to the sector for short-term business transactions or visits to civic centres or shopping at department stores. There are, however, a few long-term (over one hour) parkers making up some 13.4% of the 498 parkers observed.

Many visitors to the central market also park along this road due to inadequate parking facilities in that sector. Many taxi and bus drivers park in an erratic manner thereby causing traffic hold-ups especially around KASUPEPA office building.

Table 6: Parking Duration at Various Sectors of Kaduna CBD.

Sector	Duration (minutes)	Vehicles Parked (Numbers)	Percentage of motorists interviewed
Business/ Civic (1)	Under 10	137	27.6
	10-29	86	17.2
	30-59	208	41.8
	Over 60	67	13.4
		498	100.0
Shopping (2)	Under 10	30	32.2
	10-29	27	30.4
	30-59	16	18.3
	Over 60	17	19.1
		90	100.0
Work (3)	Under 10	64	18.3
	10-29	123	35.0
	30-59	118	33.6
	Over 60	46	13.1
		351	100.0
Others (4)	Under 10	54	38.4
	10-29	54	38.7
	30-59	17	12.0
	Over 60	15	10.7
		140	100.0

Source: Fieldwork, 1992

The patrol survey conducted along some stretches of Lagos Street and Broadcasting Road showed the parking duration in Sector Two, as given in Table 6 above. The results show that many motorists (32.2% of the 90 motorists observed) park for short-term durations. They consist mostly of commercial vehicles bringing commuters from within and outside the city to the regional park attached to the central market or to the central market for shopping purpose.

The regional park, with a parking capacity of 156 vehicles at a time, is grossly inadequate. Many incoming vehicles, therefore, park either along Lagos street or Broadcasting road for

passengers to come down. Some motorists stop to pick passengers especially those going to Zaria and Kano thereby avoiding the fees charged at the regional park by the Local Government and the National Union of Road Transport Workers.

Almost equally high is the number of parkers on medium-term basis. They are about 30% of the total number of motorists observed. On the other hand, only 19.1 of the motorists parked on long-term basis, that is for one hour or longer.

The survey was also conducted along Yakubu Gowon Way in Sector 3. A total of 351 vehicles were observed. The results in Table 6 shows that many of the visitors are medium-term parkers. Over 96% of them park for less than one hour. Many of the parked vehicles are mini buses that queue to wait for passengers at the Ahmadu Bello Way end of the road. Some of the parkers include those visiting the institutional establishments like the Central Post Office, national Livestock Department, Nigerian Agricultural and Co-operative Bank, and British Council, where there are inadequate off-street parking facilities. As a result, a lot of traffic hold ups are experienced along this and similar roads in the sector especially during peak hours.

For Sector Four, the survey was conducted along Independence Way. The results, given in Table 6, show that many of the vehicles parked are mini buses and taxis that bring workers to the workplaces in the area. Accordingly, over 70% of the 140 vehicles surveyed parked on short-term basis and only 10.7% parked on long-term basis.

Traffic hold-ups are experienced mostly around the State Secretariate especially between 7:00 and 9:00am and between 3:30 and 4:30pm. The problem of on-street parking along Independence Way has increased with the location of the 1 Mechanised Division of the Nigerian Army at Kawo which has instituted a strict prohibition of parking on the long street stretch at the frontage of its headquaters. Also, the Ranchers Bees parking area accomodates only 140 vehicles at a time thereby making the locality conjested when football matches are played as most fans have to park along the road.

3.4 PARKING PROBLEMS IN KADUNA CBD:

To determine the quantitative problems of existing parking supply, a comparison is made of the average daily accumulation and the parking supply figures. The parking duration data are used to convert the parking accumulation figures in the CBD into number of parking lots needed. Therefore, this section discusses parking demand problems. Also, the levels of deficit and/or surplus parking lots are determined by relating the estimated parking demand to the existing supply for parking discussed in Section 3.2.1 above. The implications for the parking problems, of the qualitative characteristics of parking, are also given in this section.

3.4.1 Existing Quantitative Problems of Parking:

The accumulation figures discussed above are tempered with the average parking duration and the number of vehicles a parking lot can take in a day (parking capacity). The average parking duration of 43 minutes in the Kaduna CBD was used to determine that the number of vehicles a parking lot can take in the CBD. It

CBD parking accumulation figure for 1992 was converted into total parking lots required (see Appendix 1 for conversion model). This was then set against the present level of parking facilities supplied to determine the deficits or surpluses. Table 7 below shows that there are only deficits at various levels within the different sectors of the CBD. The deficits indicate the level of the quantitative problems of parking in the CBD.

Table 7: Existing Deficits of Parking Lots in Kaduna CBD by Sectors.

Sector	Weekday Accum. (Nos. of veh.)	Existing (Lots Nos)	Total Need (Lots Nos)	Estimated Deficit of Lots (1992)
1	10906	1382	1634	518
2	8923	948	1448	571
3	9915	3168	3668	335
4	3305	819	1583	356
Total	33050	6317	8333	1780

Source: Computed from Fieldwork Data, 1992.

From Table 7 it is clear that there is the problem of limited supply of parking facilities in the CBD in relation to the demand level. This is the case in all the sectors, although at different levels of inadequacy. Sector 2 has a larger level of deficit which stands at 571 parking lots and Sectors Three has the least with a deficit of 335 parking lots. This is associated with the problem of high incidence of on-street parking with the attendant problem of traffic congestion and accidents. This is particularly accute in both Sectors One and Two of the CBD which have high levels of deficits.

3.4.2 Existing Qualitative Problems of Parking:

From the cordon count and patrol surveys it is clear that parking demand and supply problems are not evenly distributed within the CBD. In particular, The quality of parking facilities vary from one sector to another. The problems include those of inadequate supply of necessary elements of a good parking space in many of the parking spaces, poor quality of what have been supplied, etc. As shown in Table 5 above, in Sectors One and Two the proportions of unsatisfactory parking facilities to those that are satisfactory are much higher. Even in Sectors Three and Four, the number of unsatisfactory parking facilities are also unacceptably high.

This situation not only discuorages motorists from using the available facilities or use them for no alternative, but is associated with the problem of stress on the satisfactory parking areas, high incidence of car theft, etc.

The quantitative measure of parking demand is projected into the future in the next chapter.

Chapter Four: FUTURE DEMAND AND REQUIREMENTS OF PARKING IN THE CBD OF KADUNA.

4.1 PROJECTION OF PARKING DEMAND:

To plan ahead for any urban infrastructure, including transport and parking facilities, it is necessary to make projections into the future after establishing the present conditions. In this chapter, therefore, the current demand for parking is projected to estimate what it would be ten years from now. The factors taken into consideration and the results of the projection as well as the space implications are discussed below.

4.1.i Factors Considered in the Projection:

In forecasting any aspect of urban transport, including parking, several factors must be considered. Amonst these factors are, first, future landuse patterns. It is important to examine policies on future landuse in the study area as they in turn affect the results of the projection. In this regard, it was established that the large portions of Kaduna CBD is to be redeveloped into viable commercial uses (KASUPEPA, 1978). This means that commercial activities is to be enhanced. As a landuse that strongly attracts traffic, the growth of parking demand will be faster with such a project. Other central area functions are also to be improved. Already, the plan and limited implementation of the Mogadishu Development Project suggest that parking would be expanded in the area. If the policy is implemented further parking demand will substantially be higher.

Second; as noted in Chapter Two, the rate of vehicle ownership will have a direct effect on the amount of parking

facilities that would be required. During the current National Development Plan period, vehicle ownership is expected to grow at the average rate of 4% per annum. The rate may even be higher than this average in Kaduna as it is a fast-growing town. This points to a rising rate of demand for parking.

Third; the socio-economic characteristics of the people is a factor to be considered in making projection of future parking demand. It is related to the aspect of vehicle ownership discussed above. It is accepted that vehicle ownership and parking demand is rising at a slow rate owing to the stable or declining average income of the residents of Kaduna. However, that by the end of the decade, income and consequently vehicle ownership and parking demand will rise at faster rate.

Fourth; some locational decisions and planning programmes have the effect of channeling traffic to specific places leading to increase or decrease in parking demand in the places. For instance, if implemented, the planned Eastern Bye-pass project has implications for the direction and rate of physical growth of Kaduna and consequently the pattern and levels of parking demand in the whole city including the CBD. Government fiscal policies especially as they affect urban economic development also influence the demand for parking especially in aggregate terms in the city.

Within the limits of available data, these factors are considered in the projections of parking demand given in the sub-sections below.

4.1.2 Future Parking Demand in Kaduna CBD:

As explained in Chapter Three (sec 3.4.1), the average CBD accumulation figure for 1992 was converted into total parking lots required in that year. This was then set against the present level of parking facilities supplied to determine the deficits or surpluses. In this section, the parking demand (the deficits and surpluses as at 1992) are projected for a ten year period.

The computations are made at the aggregate level for the whole CBD and for the different sectors of the CBD for the years 1997 and 2002 from that of 1992 which is the base year. There is no known and officially accepted growth rate of parking demand in Kaduna. A growth rate of 4% for vehicle ownership in Kaduna could be used as proxy of the parking demand rate. This was determined from the vehicle registration figures for Kaduna which are shown in Appendix 2.

The geometric progression method was used to make the projections because it fits situations of limited data base such as ours. Thus:

$$P_o = P_1 (1+r)^n$$

where, P_o = projected demand;
P_1 = demand at the base year;
r = rate of growth of vehicle ownership or of parking demand;
n = number of years the projection is made;

The projection is made for the first five years, 1992 to 1997. For parking studies this is a short-term period in which the result is expected to be more reliable and actions based on it more appropriate. If the determinants of the growth rate of

parking demand remain stable, the long-term (1997 to 2002) projection result will equally be a valid framework for action.

With a deficit demand figure of 1780 parking lots in 1992, the 1997 deficit level would be: $Po = 1780 (1 + 0.04)^5$, that is 2166. In the year 2002, it would be 2635 parking lots.

Table 8 below gives the result of the computations for the various sectors of the CBD. With a present daily deficit of 518 parking lots, Sector One is estimated to have a deficit of 632 lots in 1997 and 767 lots in the year 2002. In Sector Two, the present deficit of 571 lots is projected to increase to 697 lots in 1997 and 845 lots in 2002. For Sector Three, the present daily deficit is 335 lots which is projected to rise to 407 and 496 lots in 1997 and 2002, respectively. In Sector Four, the present level of deficit of 356 lots is projected to stand at 434 lots in 1997 and 527 lots in the year 2002.

Table 8, Kaduna CBD: Present and Projected Levels of Parking Deficit.

Sector	Weekday Accum. (Nos. of veh.)	Existing (Lots Nos)	Total Need (Lots Nos)	Proj. Deficit		
				1992	1997	2002
1	10906	1382	1634	518	632	762
2	8923	948	1448	571	697	845
3	9915	3168	3668	335	409	496
4	3305	819	1583	356	434	527
Total	33050	6317	8333	1780	2172	2630

Source: Computed from Fieldwork Data, 1992.

4.2 REQUIREMENTS FOR PARKING FACILITIES:

The computed parking demand and projected deficits in terms of parking lots required to meet the daily parking needs in

Kaduna CBD as well as the discussion on qualitative aspects of parking have implications for the following:

a) land required to provide facilities to meet the growing parking demand; and

b) actions relating to improvements of quality of parking facilities.

These are discussed in this section to also provide a basis for making recommendations and planning proposals.

4.2.1 Land Requirements:

Results of the projections show that there is the need to provide more parking space and associated facilities in the Kaduna CBD. That is, parking facilities are in short supply in the area both in terms of quantity and quality. Indeed, this is made even more critical by the parking habits in the area whereby motorists park across or block parking lots, haukers spread their wares in parking spaces, and developers encroach on parking spaces. In a few cases parking spaces are taken up even with planning permission under economic or political pressures but does not consider the critical role of adequate provision for parking. From the figures on parking deficits above, by 1997 about 2172 and 2630 lots are projected to be required in the CBD to meet daily parking demand in 1997 and 2002, respectively. This is best appreciated when those number of parking lots are converted into space requirements.

Using the average size of 21.25m^2 for a 90° parking lot, including the aisle, the present 6317 parking lots in the CBD occupies a total of 13.4 hectares of land. This estimate includes both organised and unorganised parking areas. Assuming this would remain under parking, the additional land requirements for

parking up to the year 2002 are given in Table 9 below.

Table 9, Space Requirements for Parking in Kaduna CBD.

Sector	Nos. of Exist. Lots	Space (Ha) used for Exist. Lots	Required Space 1992 (Ha)	Space to Add 1997 (Ha)	2002
1	1382	2.9	3.5	1.3	1.6
2	948	2.0	3.1	1.5	1.8
3	3168	6.7	7.8	0.9	1.1
4	819	1.7	3.4	0.9	1.1
Total		13.4	17.8	4.6	5.6

Source: Field Survey, 1992.

The figures show that to fully meet the demand for parking large amount of space will need to be devoted to parking. If the high current level of deficits are met, then smaller amounts of land will be required for 1997 and 2002. The planning implications of this are discussed in Chapter Five.

4.2.2 Qualitative Aspects of the Parking Requirements:

Qualitative problems were identified in Chapter Three (see section 3.3.2). These need to be addressed. Also, it is done in terms of the future considerations of the requirements as the development of parking facilities does not simply involve providing open space for vehicle storage. Certain facilities are necessary for convenient and secure vehicle storage.

In Kaduna CBD it was established in Chapter Three (section 3.3.2) that Sectors Three and Four have satisfactory quality of existing parking facilities. These are the sectors with commercial establishments like banks, insurance companies, etc, where exclusive parking is provided. However, the situation in

Sectors One and Two require a lot of improvements to bring the existing parking facilities to desireable standards. These include the provision of security posts, shed/shade trees, pavement and marking or construction of individual lots, in addition to soft landscaping. Elements like security post or office and flower beds have taken up some limited space for parking lots. However, the benefits in terms of spatial order, convenient and safe parking, and aesthetics more than compensate for the marginal loss in space for lots.

Chapter Five: PLANNING POLICY RECOMMENDATIONS AND PROPOSALS.

5.1 INTRODUCTION:

In making recommendations, it is necessary to give due congnisance to the space presently under parking and the additional requirements of space for parking relating to the short-term and long-term (5 and 10 year periods) parking demands. This is important because the Kaduna Central Area is already almost wholly built-up and any available vacant space should be used judiciously. This chapter sets out these details and policy recommendations are made appropriately. Some design proposals are also made to demonstrate the application of some aspects of the recommendations.

5.2 SPACE INVENTORY IN KADUNA CBD:

From Table 9 in Chapter Four, the space covered by parking at the time of our surveys is given according to the various sectors of the CBD. The land requirements based on the accumulation figures, obtained from field studies, are shown. The amount of parking space required to be added to accomodate the projected levels of parking demand is also given in the Table.

Currently, 13.4 hectares or 2.6% of total land area of Kaduna CBD is for parking. The projected amount of additional land required for 100% off-street surface parking in 1997 is 4.6 hectares and in 2002 it will rise to 5.6 hectares. Within the context of the CBD area totalling 508 hectares, and the intensity of development of the land under the various central functions, this constitutes a planning challenge. Even if less than 100% parking is aimed for, the challenge remains in view of the fact of very limited availability of vacant land in the CBD. Indeed,

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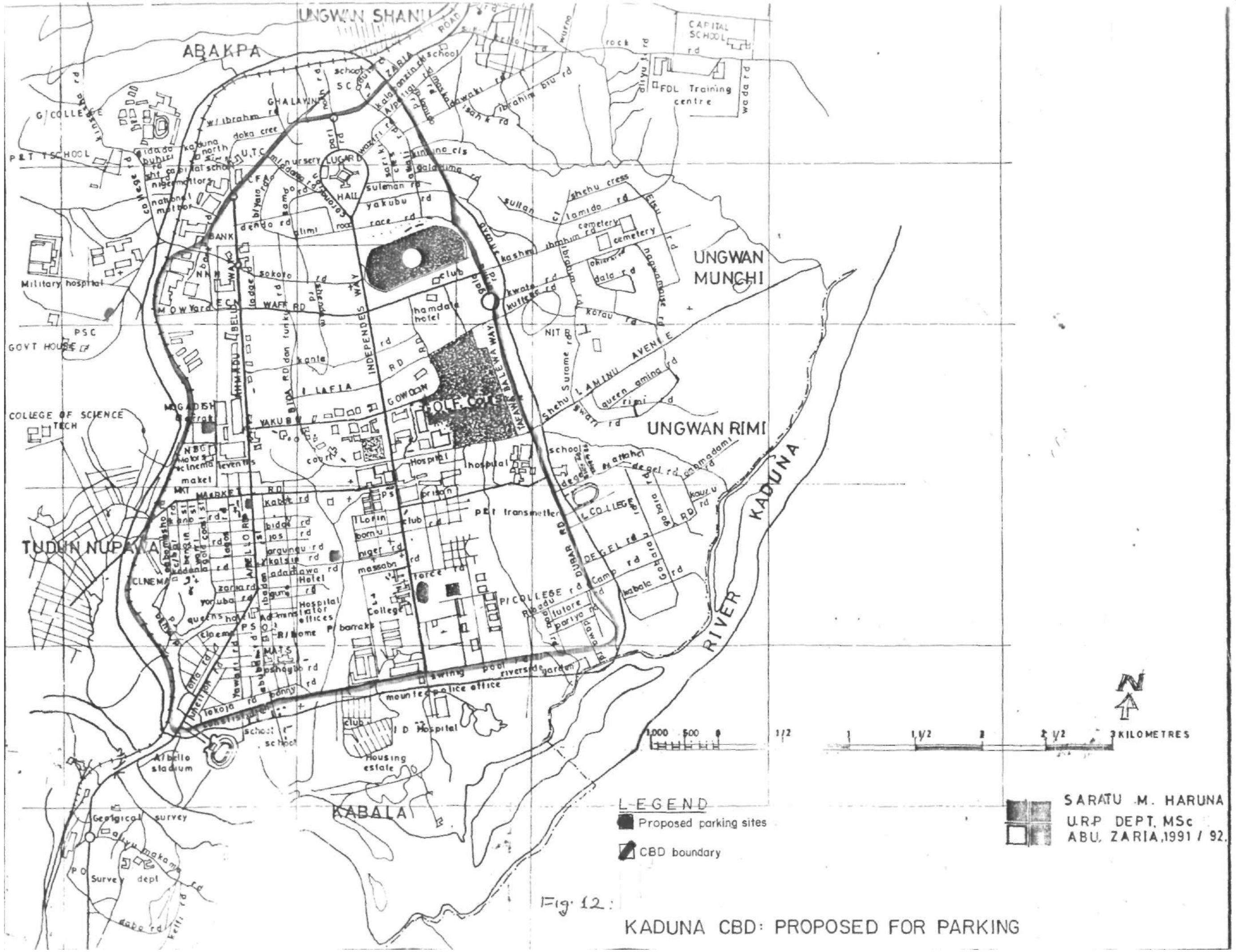


Fig. 12:

KADUNA CBD: PROPOSED FOR PARKING

of goods and convenient parking for their customers. The owners and operators of public transport will want free traffic lanes to enable them save time. For commercial vehicle dirvers, if parking space is not provided, they can park in any available space causing more problems (Wells, G.R, 1975); as is commonly the case in the core parts of Kaduna CBD.

A well planned provision of parking facilities is to satisfy these diverse parking preferences and still maintain free flow of traffic especially in the CBD which is the nerve centre of a town. To accommodate the various conflicting demands for parking at the CBD in order to maintain a free flow of traffic, a balance should be struck in the provision for long-term and short-term parking. By so doing, streets along which either short-term or long-term parking should be allowed are to be identified.

Accordingly, It is recommended that some 5 - 10% of the computed parking demand may be met through on-street parking which is to be allowed on some roads within Sectors One and Two. These include Ibrahim Taiwo Road, Ahmadu Bello Way, etc. This is to be controled in favour of delivery vans. Also, parking duration is to be controled by patrol personnel of KASUPEPA or the Local Government, that is, discouraging long-term parking. It should only be for picking and dropping passengers where waiting time is to controled through time restrictions, that is, for limited time durations and specific times of day. Parking metres may be placed on the marked parking bays and some fees charged for parking beyond a given time period. On narrow streets where shops do not have rear goods delivery bays, on-street parking should be allowed, principally for that purpose, on one or both

sides depending on the street width. It is recommended to introduce these measures along the stretch from Savannah Bank roundabout to Katsina Road roundabout.

In the provision of off-street parking facilities the planner should separate between:

a) parking facilities available for the use of the general public either on payment of fees or free, ground level or multi-storey, public or privately owned.

b) parking for only a specific class of users such as factory workers, particular office visitors or shoppers at a particular store.

Two major guiding principles are used in addressing the question of parking in the Kaduna CBD. First is the provision of ground level parking facilities at strategic locations to be effectively linked in order to meet the parking demand in Sectors One and Two of the CBD which have higher levels of parking problems but also have limited vacant space for the provision of parking facilities. Second, some traffic management techniques are required to reduce the levels of parking accumulation in the CBD.

The vacant sites identified in section 5.20 (see Fig 12) are to be acquired and developed by KASUPEPA for parking provided with adequate security and shade trees. Some fees should be introduced to support maintenance of the parking facilities. The plot of land currently used by Ikara Motors, for instance, is approximately 30 x 30m. It can accommodate about 45 vehicles based on 90° angled parking design. This meets some 3.1% of the present level of parking demand in Sector Two and all the long-term parking demand at the central market and other nearby

commercial areas. Surface parking is recommended because of the prohibitive cost of providing multi-storey parking facilities. It is also posible to achieve the same objective if Ikara Motors would construct the premises devoting the ground level wholly for parking.

It is also recommended that that part of the Mogadishu Project area which is used as taxi park, motor mechanic workshops and refuse dump be designed and developed for public parking. The mechanics may be re-located at Panteka Mechanic Village along the Western by-pass. This will provide land measuring about 50 x 50m which can be developed to accommodate over 100 vehicles or 1.2% of the present demand in the CBD or approximately 6% of the current level of parking demand in the Sector. By their location parking in these areas will reduce the congestion along Ahmadu Bello Way and around the central market and adjoining business premises. By reducing on-treet parking, it will consequently reduce the daily road accidents caused by parked vehicles limiting the road capacity.

In addition, the authorities in charge of the central market should make effort to restore the areas meant for vehicle parking which are currently occupied by hawkers or used as refuse dumps. This may be done by relocating the traders, clearing the dumps and providing a buffer between the central market and the parking areas. If that is done, some 50 more parking lots (3.1% of the deficit in Sector One) will be added to the present level of parking supply. This is particularly so for the ~~for the~~ area facing the main entrance of the central market on its western end.

some selected vacant spaces are identified in the former sectors to develop for surface parking. This suggests that some motorists going into Sectors One and Two will need to travel by public buses from these parks and drive back after completing their businesses. The development of attractive car parks in this way will also help to exclude many private cars from the core area thereby reducing the traffic congestion and parking demand in the CBD. The piece of land 'behind the Pilgrims Welfare Board measuring about 50 x 100m is to be acquired, designed and developed for this purpose. When that is done, some 236 vehicles can be accommodated there at peak periods and it can take care of about 64% of the parking demand of Sector Three and 2.8% of the current total deficit of parking lots in the CBD.

5.4 THE DESIGN PROPOSALS:

Provision of on-street or kerbside parking facilities involves relatively less expenditure. In the design of on-street parking facilities, parallel rather than angled parking (see Fig. 13) is generally preferred on safety grounds. It is known that angled parking is more convenient for motorists because it requires less vehicle manouvering in and out of the parking space. It also gives room to accommodate more vehicles along a street compared with the parallel design. However, it reduces more road capacity is a major cause of road accidents. Where angled parking is necessary in the design of on-street parking, 45° to the kerbside is preferred to 60° or 90° angle parking. Figure 14 demonstrates the application of this design principle

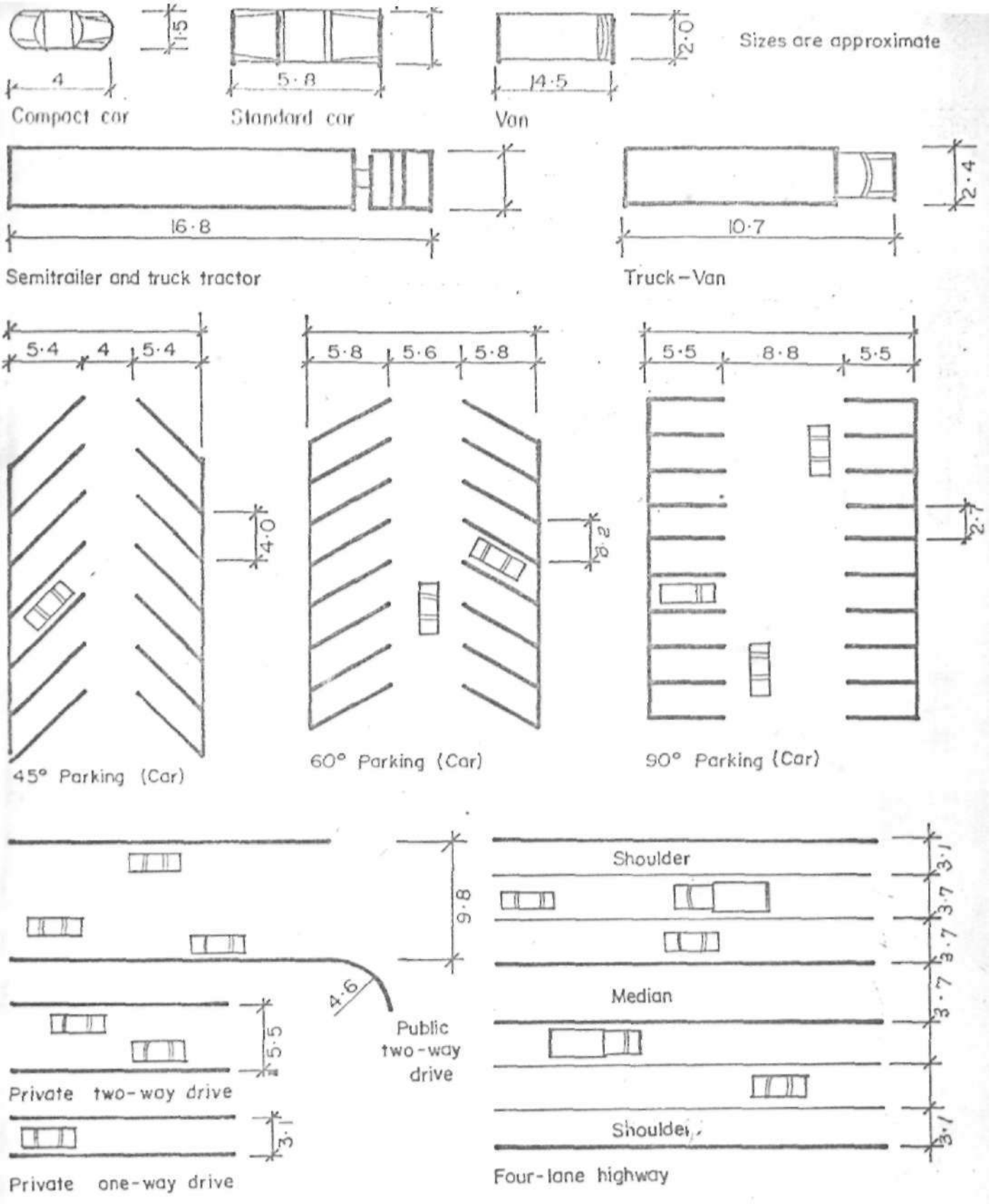


Fig. 13: STANDARDS OF PARKING SPACES

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M. Sc.(URP) Thesis 1991/92
A. B. U., Zaria

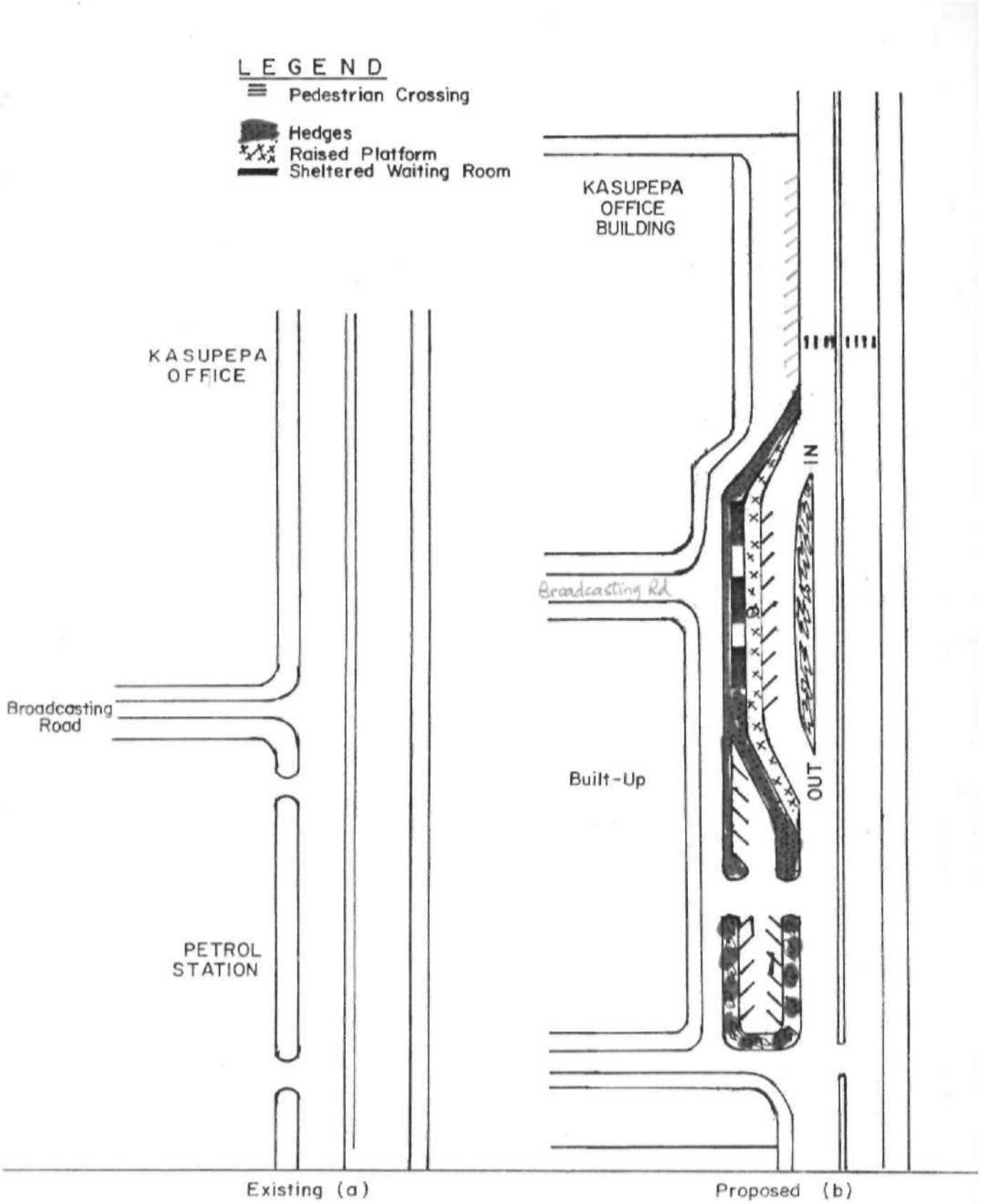


FIG. 14: DESIGN PROPOSAL FOR ON-STREET PARKING ON AHMADU BELLO WAY

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A. B. U., Zaria

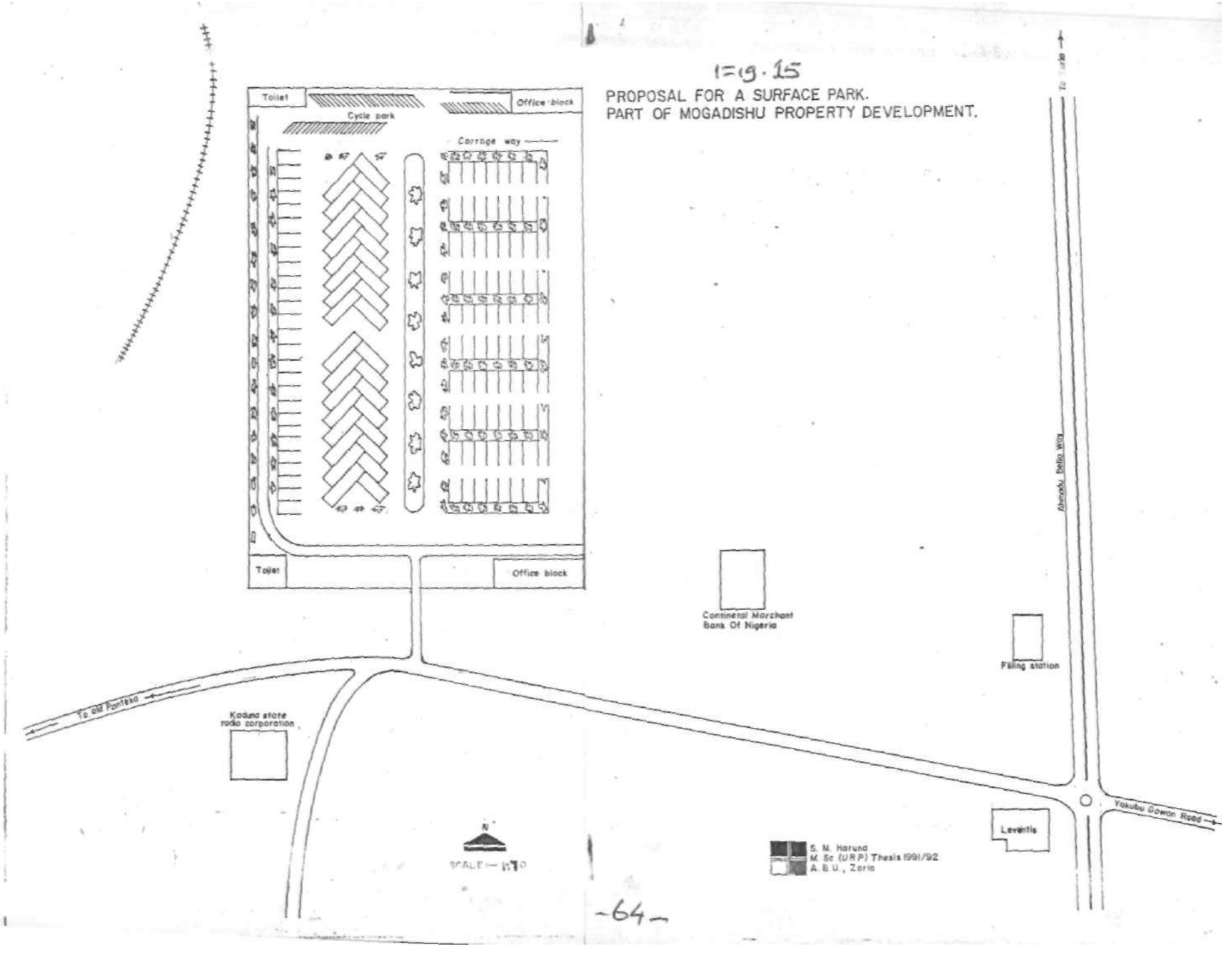
on a selected stretch of Ahmadu Bello Way.

Another aspect of the design proposal relates to off-street parking facilities. As explained earlier, these are parking facilities that are provided one hundred per cent off the transit thoroughfare. In designing a parking space, organising the individual parking lots or bays on the 90° angle to the access lane (see fig 13) makes for more economical space use. A design standard of 90° parking with an average vehicle space of 2.45 x 5.50m and minimum aisle width of 5.50m for two-way operation and 3.65m for one-way operation is recommended for the surface parking to be provided in the CBD. This allows for effective use of the limited vacant space available in the CBD. Other lower angles as 45° and 60° parks make for ease of movement within the parking area but have the disadvantage of giving fewer parking lots. A mix of the various angle parks are indeed recommended depending on the characteristics of the particular spaces identified for parking in the CBD.

For the purpose of demonstrating the application of the above design standards and principles, one of the vacant sites recommended for parking in Kaduna CBD (see contextual map: fig. 12) is taken for the detailed design. The requirements incorporated in the design are security post, shade trees, landscape and individual parking lot partitions. The result is shown in Figure 15 which details out the organisation of a portion of the Mogadishu Project site for surface parking. As indicated above it provides convenient parking that meets some 6% of the present total deficit of parking lots in Sector One of the Kaduna CBD.

Fig. 15

PROPOSAL FOR A SURFACE PARK.
PART OF MOGADISHU PROPERTY DEVELOPMENT.



5.5 GENERAL RECOMMENDATIONS:

The policy and design recommendations given in sections 5.3 and 5.4 are aimed to attain the objective of a planned provision of parking thereby removing existing parking problems. They have implications for, and need to be supported with, other actions. These are discussed in this section.

To decongest the central market and reduce the level of parking demand in that area, another market equipped with facilities comparable to those at the central market should be established. The new market or commercial area should be at the eartern part towards which the future growth of the town is anticipated to go. It would attract a sizeable number of shoppers and traders thereby reducing the parking demand at the present market. There is a plan to prepare a plan for the development of that part of Kaduna which is to be associated with the eastern bye-pass. The proposed new market should be an element of the plan. The bye-pass will also reduce the number of vehicles passing through the CBD thereby allowing for the recommended provision of on-street parking facilities on Ahmadu Bello Way.

The existing policy requiring that new property development in the CBD is to include provision for parking within the site, should be enforced by KASUPEPA in the approval of building and site plans. This should also apply to new buildings outside the CBD to forestall future parking problems.

The proposed urban renewal project, especially for the decaying parts of the CBD, should be re-activated. This will allow for renewal of of the physical developments and provision

for parking within the project area.

There are many evidences of bad road-user habits in Kaduna in terms of general driving and parking practices. These add to the problems of traffic flow and shortage as well as poor use of parking facilities. Traffic regulations need to be enforced in the town to attain the desired result. Therefore, it is recommended that a unit be set up in KASUPEPA which is mainly to carry out transport and parking studies, prepare detailed parking and road improvement designs, supervise the implementation of the proposals, and liase with eisting traffic management agencies to promote and enforce acceptable driving and parking practices in Kaduna.

Sidewalks and traffic lanes are encroached on in many places by informal sector activities such as hawkers. This limits kerbsides which could be used for short-term on-street parking. These should also be detected and penalised by staff of the proposed Transport Unit of KASUPEPA in association with traffic wardens.

5.6 CONCLUSION:

The findings in this study revealed and explained several problems of parking in Kaduna CBD as well as the inadequacies of the few existing policies that relate to parking in the area. Policy recommendations and design proposals were then given which are based on the fidings and therefore expected to be more effective. They point to the need for a unit in KASUPEPA which will, among other things, continue to generate data on parking within the CBD and other areas of intense landuse in Kaduna town.

Also, the lessons from this study suggests that it is necessary to carryout similar studies in other large towns in Kaduna state and other states of Nigeria. Those studies may reveal similar trends as in Kaduna as well as other peculiarities which would together form a basis for policies at the national level for effective urban transport and parking. These will also have implications for issues like urban environmental management, landuse and urban administration, etc, which constitute possible directions of research arising from this kind of study.

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Appendix 1: Model for Converting Parking Accumulation into Number of Parking Lots Required.

$$\frac{Ac - Lp' + Lp}{Pd} = Pn$$

Where: Ac = Average Accumulation
Pd = Average Parking duration for Area or Sector
Lp = Lots used for long-term Parking
Pn = Parking Lots Needed for Area or Sector

APPEDDIX 2: Number of Vehicles Registered in Kaduna by Type of Ownership, 1980.

Registered Vehicle Type	Year										
	1981	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91
Private	400	540	660	750	850	520	430	380	210	200	180
Commer-cial	520	620	750	870	960	965	900	880	750	680	500
Goods van	60	95	120	150	180	175	120	95	50	35	20
Total	980	1255	1530	1620	1990	1660	1450	1355	1010	915	700

Source: Kaduna Licensing Office, May 1991.

Government vehicles owned by Government, Agricultural vehicles (like tractors) and motor cycles are not included.

Appendix 3: Data Sheet for Cordon Count, Kaduna CBD Parking Survey, 1992.

Traffic Flow Direction: Please sketch location on back of sheet number 1.

Mark / in column for each vehicle observed.

Use fresh forms for each hour (time period).

Observation Station ---------- Date ---------- Day ----------

Time	Bycycles/m-cycles	Cars/taxis	pickup trucks/ delivery vans	trucks/ large buses
6-7 am				
7-8				
8-9				
9-10				
10-11				
11-12				
1-2 pm				
2-3				
3-4				
4-5				
5-6				
6-7				
7-8				

Appendix 4: Sheet for Parking Duration Survey in Kaduna CBD, 1992.

Enumerator's Name ---------- Date ---------- Day ----------

Vehicle type	Reg. Number	Time (to nearest minute) Time In	Time out	Time Diff.