Nairobi CBD parking survey

Institute for Transportation and Development Policy

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1. Introduction

Parking has a profound effect on the urban land use and transport system, affecting traffic patterns, pedestrian access, and urban form. While cities traditionally focused on parking as a supply issue, attempting to provide more parking to accommodate "predicted" demand, smart cities now recognise that parking is an important lever to manage the use of personal motor vehicles. More and more governments are introducing performance-based pricing for on-street parking, introducing moratoriums on government-subsidised parking, and setting maximum parking standards in new private developments. The goal of these management techniques is to control the supply of parking, especially in areas with good access to public transport, thereby encouraging a shift toward the use of public transport, walking, and cycling.

The Kenyan government is focused on the implementation of a mass rapid transit system for the city of Nairobi, including a multi-corridor bus rapid transit (BRT) network. Several BRT corridors converge on the Nairobi central business district (CBD), and it is essential that the infrastructure there have the capacity to accommodate high bus frequencies and heavy passenger volumes. The CBD sees many competing demands on road space, including the movement of public transport and personal motor vehicles, public transport staging, personal motor vehicle parking, pedestrian movement, and vending. The successful integration of future BRT corridors in the CBD environment will depend on the appropriate allocation of road space among these various uses. To help inform the design of the CBD corridors, the Institute for Transportation and Development Policy (ITDP) conducted a parking survey to quantify the demand and supply for parking. These data provide a picture of the distribution of parking across the CBD and will help authorities design strategies to manage parking as part of a larger restructuring of public transport services and public space in the CBD.

2. Existing parking system

Parking policy in Nairobi has centred around the desire to raise revenue for the local authority while keeping fees low in an attempt to make the CBD attractive for visitors. Less attention has been paid to the potential role of parking in managing travel demand.

Currently, the Nairobi City County (NCC) government charges KES 300 per day for on-street parking and KES 400 per day in municipal off-street car parks. Nairobi originally had parking meters, but they were removed in the late 1990s and a flat rate of KES 70 per day introduced for on-street parking. In the following years this fee has progressively increased to KES 140 in November 2008 and KES 300 in February 2014. These price adjustments have often been geared at raising revenues as opposed to managing demand, and the prices are too low to have a sizable impact on commute behaviour. Consequently, reports estimate that over 30 percent of the typical traffic congestion observed in the city is caused by drivers searching for a parking spot.[1]

According to a parking survey carried out by IBM in 2011, Nairobi was found to be amongst one of the worst cities to find parking.[2] The study determined that motorists on average take

[1] https://www-03.ibm.com/press/us/en/pressrelease/35515.wss
[2] http://www.cio.co.ke/news/main-stories/Nairobi-worst-city-to-get-parking,-says-IBM-survey

31.7 minutes against a global average of 19.8 minutes to find a vacant parking slot. Apparently, nearly three out of four commuters surveyed reported not reaching their intended destination because they gave up looking for parking. This not only results in congestion and increased local pollution and greenhouse gas emissions, but also wastes commuters' time and leads to lower productivity. Ostensibly there exists a need to better understand the parking needs of the city's citizens and combine this with real time relay of transport information to better match the parking supply with demand from commuters.

Already, improvements in the parking management system have been made, at least in the area of revenue collection. In September 2014, the NCC introduced a new electronic mode of payment for parking fees in an attempt to reduce the time motorists previously spent in obtaining parking tickets manually. Equally, it aims to boost revenue collection for NCC by sealing loopholes that the County experienced under the former manual collection system.

2.1.1 Fee payment

Public on-street parking fees in Nairobi are paid through an electronic payment system dubbed Ejijipay. The cashless system which was introduced on 1 September 2014 and allows Nairobi motorists to use their mobile phones to pay for parking across the city. Ejijipay is part of NCC's e-payment system, a self-service portal that allows Nairobi residents to pay for services electronically.[3]

To pay for parking, motorists first need to register on the platform. This can be done in the following ways:

1. Nairobi City County ePayment app available for Android, iOS, and Windows Mobile.
2. Unstructured Supplementary Service Data (USSD) code *217#
3. Website: www.epayments.nairobi.go.ke
4. Agency: This is a network of physical pay points spread across the city.

The registration process captures the user's name, phone number, national ID/passport number and year of birth and prompts the user to create a personal identification number to access the system. An e-wallet is then created, and users can load money through a bank; a mobile money platform such as M-pesa, Airtel money, Yu-cash, and Orange Money; or through an NCC agent. Once the account is loaded, the motorist can then use Ejijipay to pay for daily parking, seasonal parking, parking for matatu saccos, or penalties, or check the status of his or her payment. The payment process involves the motorist keying in the vehicle registration number and choosing the parking location from a dropdown list. Once the payment has been made, he or she receives a confirmation message via SMS.

In the event that a motorist is low on funds in the e-wallet account or is not registered on Ejijipay, there is an option to pay a county parking attendant in cash who in turn completes the transaction electronically using an NCC-issued phone.

2.1.2 Enforcement

[3] Aside from parking payments, this system allows resident to pay electronically for single business permits, land rates, and rent for County houses.

The role of parking attendants is to ensure drivers follow parking regulations on public streets and parked vehicles have paid the necessary parking fees. The attendants are equipped with an NCC-issued phone that has an application to check whether a vehicle has paid for parking. To check the status of a vehicle, the attendant keys in the car registration number. If a vehicle is found to be non-compliant, the attendant can proceed to record the violation using the smart phone app and issue a penalty fine of KES 2,000. Simultaneously, the system captures the location of the vehicle and sends a request for an enforcement officer to physically clamp the vehicle. If the motorist does not settle the fine before the end of the day, the vehicle is towed and taken into the council's custody until such a time that all fines and towing costs are settled.

At the moment, defaulters are only compelled to pay fees and penalties if their vehicles are physically clamped. This is due to the fact that NCC bylaws do not allow for the payment of fines in arrears. As a result, a defaulting motorist who is not physically clamped and charged on the day of the infraction eludes the fine as it is not possible to accumulate the fines beyond the default day. City Hall is aware of this loophole, and is in the process of amending county by-laws to allow it to accumulate charges on motorists who default on paying daily parking fees.[4] Another loophole stems from the fact that the system does not automatically issue a fine when a vehicle is found to be unpaid. Instead, the decision to issue a fine is left to the discretion of the parking attendant. Furthermore, it is unclear whether NCC employs service level standards to ensure that attendants check a minimum number of vehicles each day. As a result, many defaulting vehicles may go unchecked.

3. Methodology

The Nairobi CBD parking survey sought to quantify current parking patterns in the CBD area by collecting data on the existing parking capacity and demand. The objective is to analyse the impacts of proposed BRT corridors on parking supply and inform the design of parking management measures.

The survey was conducted in the month of January 2016. It primarily focused on:

- Public on-street parking
- Off-street
    - Publicly owned with public access
    - Privately ownership with public access

Lots that are privately owned and only accessible to private parties were not included in the survey. The study area was the Nairobi CBD, an area of approximately 1.6 sq km. Figure 1 below depicts this area and articulates the streets of interest for the survey.

[4]http://www.businessdailyafrica.com/City-Hall-plans-amending-laws-to-catch-parking-fee-defaulters-/-/539546/2634584/-/i10xbu/-/index.html

Figure 1: Study area boundary (left) and streets (right).[5]

Three types of surveys were carried out:

- Parking inventory survey
- Occupancy survey
- Turnover survey

The parking inventory survey was conducted by ITDP while the occupancy and turnover surveys were done with the assistance of third year civil engineering students from the University of Nairobi and ITEC Engineering consultancy under supervision by ITDP.

3.1 Parking inventory survey

Existing inventory data were sought from the NCC transport unit, information technology cell, and the parking department.[6] Two sets of data were obtained:

1. Parking inventory survey performed in 2012 by the transport unit.
2. 2014 data from the ICT and parking management department.

The data sets contained the number of on street parking spaces for each street in the CBD. The streets were identified by name but with no supporting map to determine where the inventory count started or ended, so it was difficult to locate the precise extent of the street segment in question. This made attempts to relate the data with geocoded CBD maps developed at ITDP problematic. Figure 2 demonstrates the format of the NCC data with street names and references to landmarks. In the absence of any cardinal directions, only an approximation of where the block begins and ends could be made.

[5] Black lines are main avenues, blue lines are parking along those avenues, and white lines are supplementary streets. Source: Google Maps.

[6] The parking department, commonly referred to as Room 40 and conjunction with the ICT department are responsible for managing the online parking payment system.

Furthermore, the data did not include the total number and capacities of off-street parking lots in the CBD. Thus, in an attempt to make meaningful use of the data, the NCC inventory data were reviewed as a reference but new primary surveys were supplement these sources.

	A	B	C	D	E	F	G
1		STREET	TOTAL N0.OF PARKING SPACES	N0. OF LOADING ZONE	N0. OF SEASONAL TICKETS	RESERVED PARKING	NET PARKING
26		**TOTAL**	**638**	**122**	**257**	**4**	**260**
27		**ZONE 3 - MONROVIA /M. MBINGU/BIASHARA/M.DADA/**					
28	1	ANNEX	49	2	18	17	12
29	2	CITY MARKET	64	-	30	-	33
30	3	EQUITY	30	7	12	1	11
31	4	STEERS	33	1	12	-	18
32	5	MASINDE MURIRO UN	22	-	8	-	14
33	6	UPPER KOINANGE	34	6	15	-	13

Figure 2: Snapshot of the 2014 parking inventory data supplied by NCC.

The inventory survey commenced with a preliminary site survey to identify the areas with publicly accessible parking spaces. Following this, the parking inventory survey was conducted from 18th to 21st January 2016 where the supply of all on-street and off-street parking spaces was quantified. The parking spaces were categorized according to type i.e. on or off-street, orientation of parking (Parallel, Angle and perpendicular) and the number of marked and un-marked spaces available for handicap, loading zones and general parking.

Close to 50% of the spaces observed were unmarked, in such cases an estimate of the capacity of the street was made by measuring the length of the road and subtracting the sum of the widths of all driveways and the sum of the widths of all no-parking areas from the total length for each block face. The resulting length was then multiplied by the width of the parking area (e.g., 2 m for parallel parking) and divide by the area of a typical parking space (e.g., 10 sq m for parallel parking), to convert the total available parking area into equivalent car spaces. The breakdown of different categories of spaces is as shown in Table 3-1.

Table 3-1: Breakdown of existing on-street parking spaces.

Public marked spaces	Public unmarked spaces	Official reserved spaces	Informal reserved spaces	Disabled spaces	Total
2,536	2,026	382	142	12	5,098

With improved parking layouts and standardised parking slot sizes, as shown in Table 3-2, the parking capacity of the CBD streets was recalculated and it was determined that

approximately 308 new spaces can be created without impeding traffic or compromising other street uses.

Table 3-2: Space requirement for various parking layouts

Angle	0	30	45	60	90
Manoeuvring space width (m)	3.0	3.0	4.5	5.0	7.0
Parking space width (m)	2.0	2.3	2.5	2.5	2.5
Space per car (sq m)	25	33	33	30	30

The newly estimated street capacity and parking orientation were used as the parking inventory and are shown in Figure 3. The total length of streets was approximately 18 km. In addition, 22 publicly accessible off-street parking lots were surveyed. Most of the parking spaces on the supplementary streets east of Moi Avenue were identified as primarily serving as waiting bays for public service vehicles (PSVs). Thus, streets with over 70% of parked cars comprising of PSV's were considered as PSV only streets in the inventory count.

Table 3-3: Observed vs ITDP proposed parking capacity

Observed spaces	ITDP Proposed Spaces
5,098	5,406

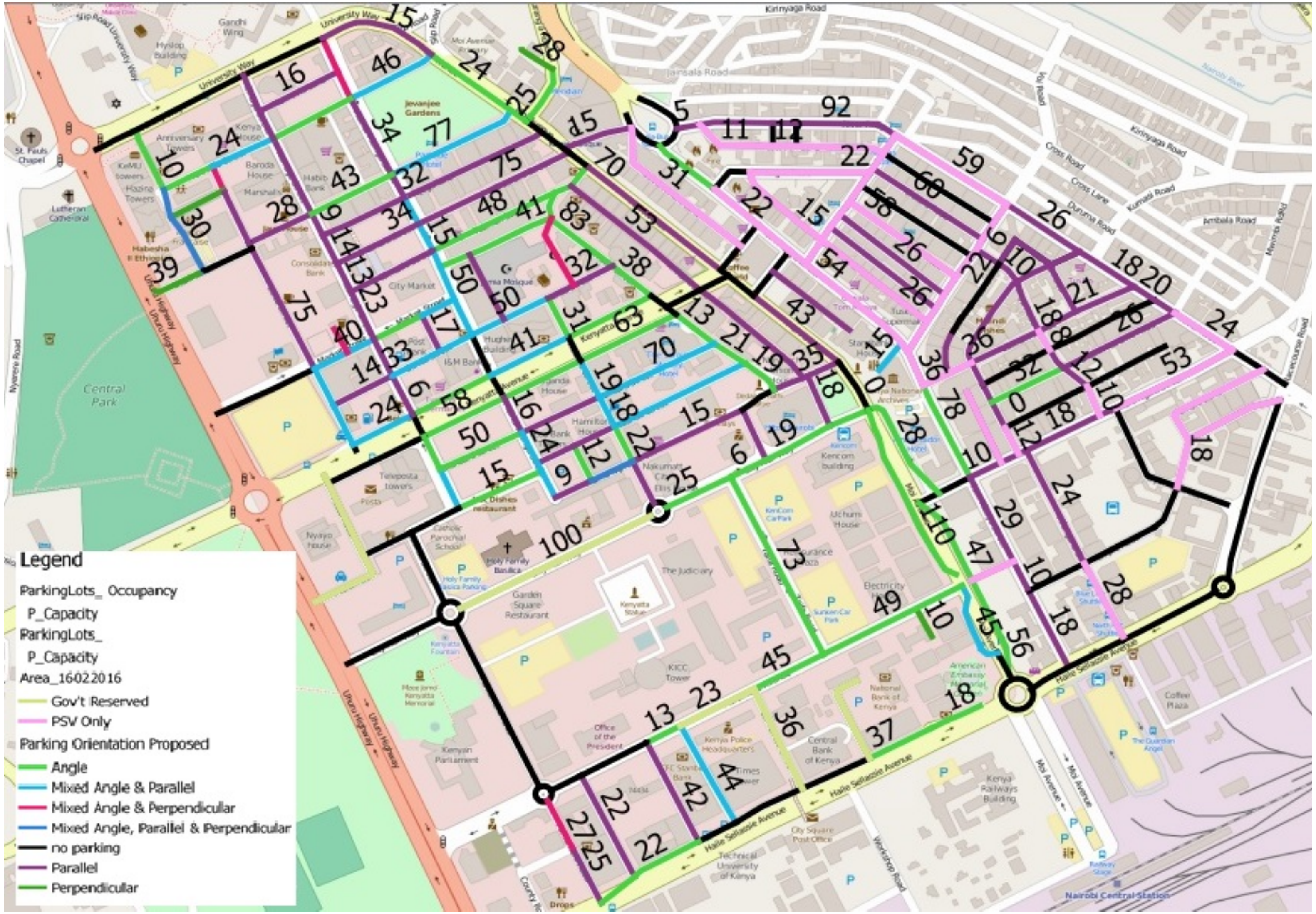

Figure 3: Parking orientation and on-street parking capacity.

Figure 4: Publicly accessible off-street lots included in the survey.

3.2 On-street occupancy survey

The objective of the occupancy survey was to determine the number of parked vehicles, including authorised and unauthorised vehicles, parking between 6 a.m. to 8 p.m. on a typical weekday. The on-street parking occupancy survey involved counting the total number of vehicles parked along each block face. The vehicle counting was carried out every hour non-stop in two shifts; Shift 1, 0600-1300 hrs, and Shift 2, 1300-2000 hrs. Each student was assigned a set of blocks that measured approximately 2 km in length. Where possible, the blocks were assigned in an order that would allow the surveyors to begin and end at the same block at the end of each round. The vehicles counted were converted into equivalent car spaces using the conversion factor presented in Table 3-4.

Table 3-4: Equivalent car space conversion factor

Vehicle	Parking slot dimensions	ECS
Two wheeler	2 m x 1 m	0.2
Mini Bus	2.6 m x 8 m	1.5
LCV	2 m x 5m	1.0
HCV	2.4 m x 9 m	2.2
Cycle	2 m x 0.5 m	0.1
Car	5 m x 2 m	1.0
Bus	15 m x 2.6 m	3.9

Tuk-tuk	3 m x 1.5-2 m	0.6

Figure 5 shows the summary of results with the occupancy on each individual street at the peak hour, from 12:00 to 13:00 hrs. Green indicates an overabundance of parking (occupancy less than 50 per cent); light green indicates occupancy from 50 to 80 per cent, yellow indicates good availability (80 to 100 per cent of spaces occupied); orange indicates that parking is effectively full (100 to 120 per cent occupancy) and red indicates excessive demand (over 120 per cent).

Table 3-5: Summary of on-street parking occupancy from 12 to 13:00 hours

	Zone 1	Zone 2	Zone 3
Parked vehicles (ECS)	1,855	1,586	1,247
Available spaces (ECS)	2,040	1,705	1,359
Occupancy	91%	93%	92%

3.3 Off-street parking occupancy survey

The survey involved counting the number of vehicles parked in off-street parking lots every hour for a 14-hour time period. Figure 6 illustrates the off-street parking occupancy with the size of the circle being proportional to the size of the parking lot.

Table 3-6: Summary of off-street occupancy from 12:00 hrs to 13:00 hours.

	Zone 1	Zone 2	Zone 3
Parked vehicles (ECS)	850	1,232	151
Parking Space	1,622	1,781	129
Occupancy	52%	69%	117%

The parking lot on KICC grounds was originally intended to be surveyed but this proved challenging as it does not fall under the jurisdiction of NCC and requires a separate authorisation from the KICC Security department. Additionally, due to its proximity to Parliament buildings, it is mostly occupied by government official cars making the processes of obtaining security clearance even the more difficult particularly within the limited time frame the CBD parking survey was to be completed.

A turnover survey of the off street parking lot at NSSF was initially planned. However, this as well proved exceptionally difficult to conduct due to the management of the lot not only denying entrance to the site but also prohibiting the stationing of surveyors at the entrance and exit of the lot or on adjacent streets. Surveyors had to be stationed at the junction of Loita Street and Market Street after the manager disregarded the survey authorisation provided by NCC, on the grounds that the plot is private property. The manager of the NSSF lot threatened harm if the survey proceeded near the parking lot. Interventions by ITDP and an NCC engineer were not successful at diffusing the tension. Ultimately, as vehicle license

plate numbers could not be observed at the distance, a count of vehicles entering and exiting the lot was undertaken to determine occupancy rates.

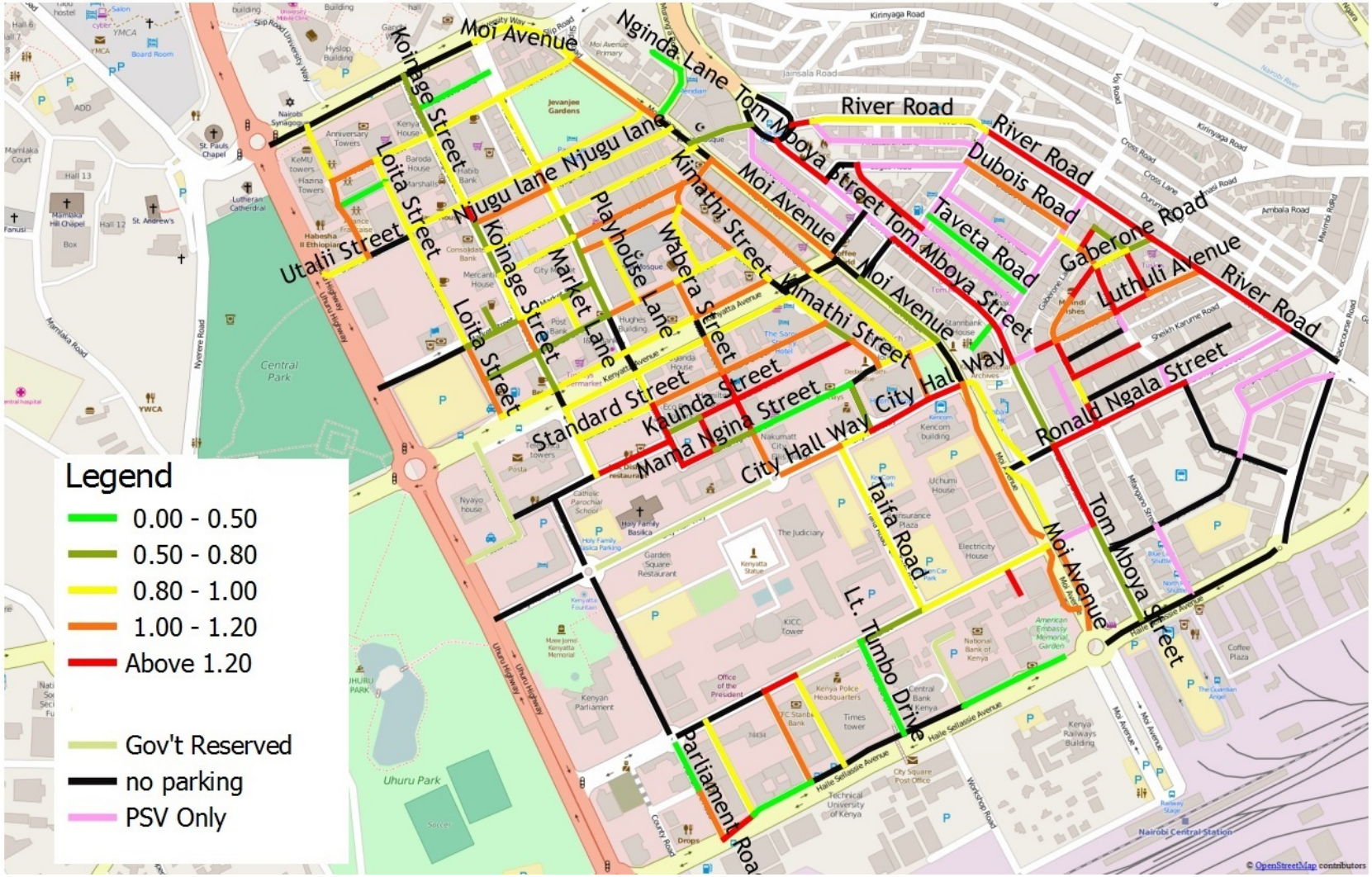

Figure 5: On-street occupancy rates.

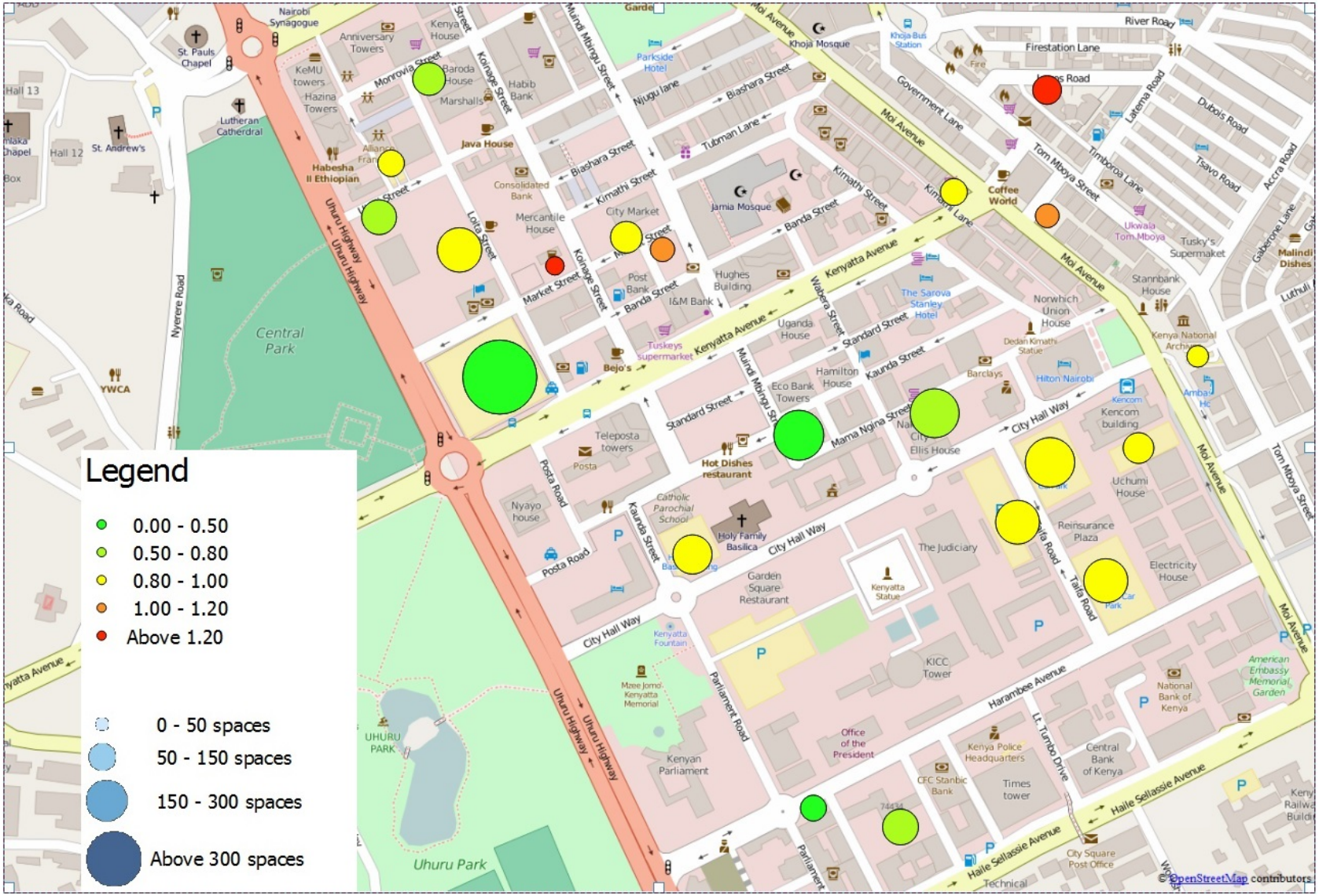

Figure 6: Off-street parking occupancy.

The results are divided into three zones, as shown in Figure 7. Zone 1 includes the area north of Kenyatta Avenue and west of Moi Avenue as well as spaces on those streets. Zone 2 consists of the area between Kenyatta Avenue and Haile Selassie, including spaces on those two streets. Zone 3 covers the area east of Moi Avenue, up to and including River road.

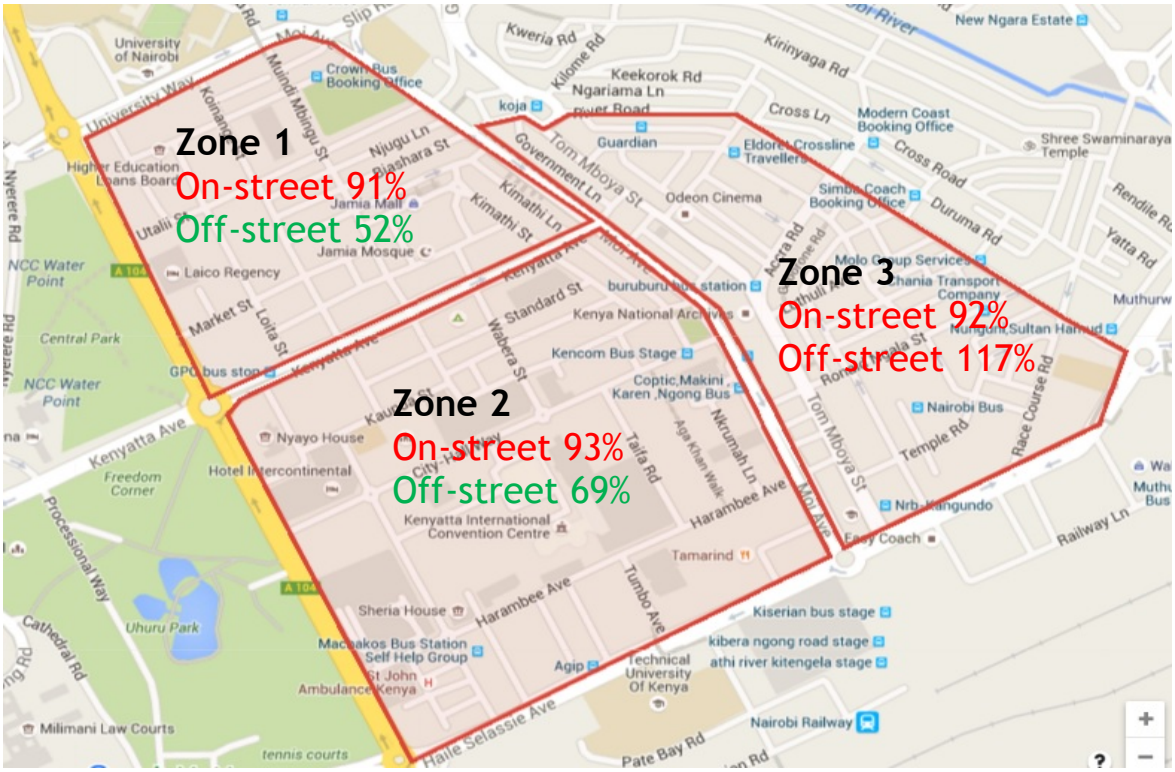

Figure 7: Overall parking occupancy in major zones of the CBD.

3.4 Turnover surveys

In the turnover survey, the surveyors recorded the license plate number of every vehicle parked along the respective block face as well as those in the respective off-street parking lots. The license plates were recorded every hour from 6.00 a.m. in the morning until 8.00 p.m. (14-hour time period).

The on-street turnover survey covered major avenues of Kenyatta, Moi Avenue, Haile Selassie, Koinange Street and Muindi Mbingu Street. Each surveyor was assigned a set of blocks that covered approximately 1 Km. There was some slight disruption experienced from 16:00 to 16:30 due to rain, but this did not affect the overall data collection as the survey resumed immediately the rain subsided.

The average length of stay for the whole area is 3 hours and 20 minutes. Most vehicles park for a short period of time, yet most of the available parking capacity is occupied by a minority of vehicles that park for long durations. This pattern is illustrated in Figure 10, which displays the turnover results in terms of vehicle-hours.

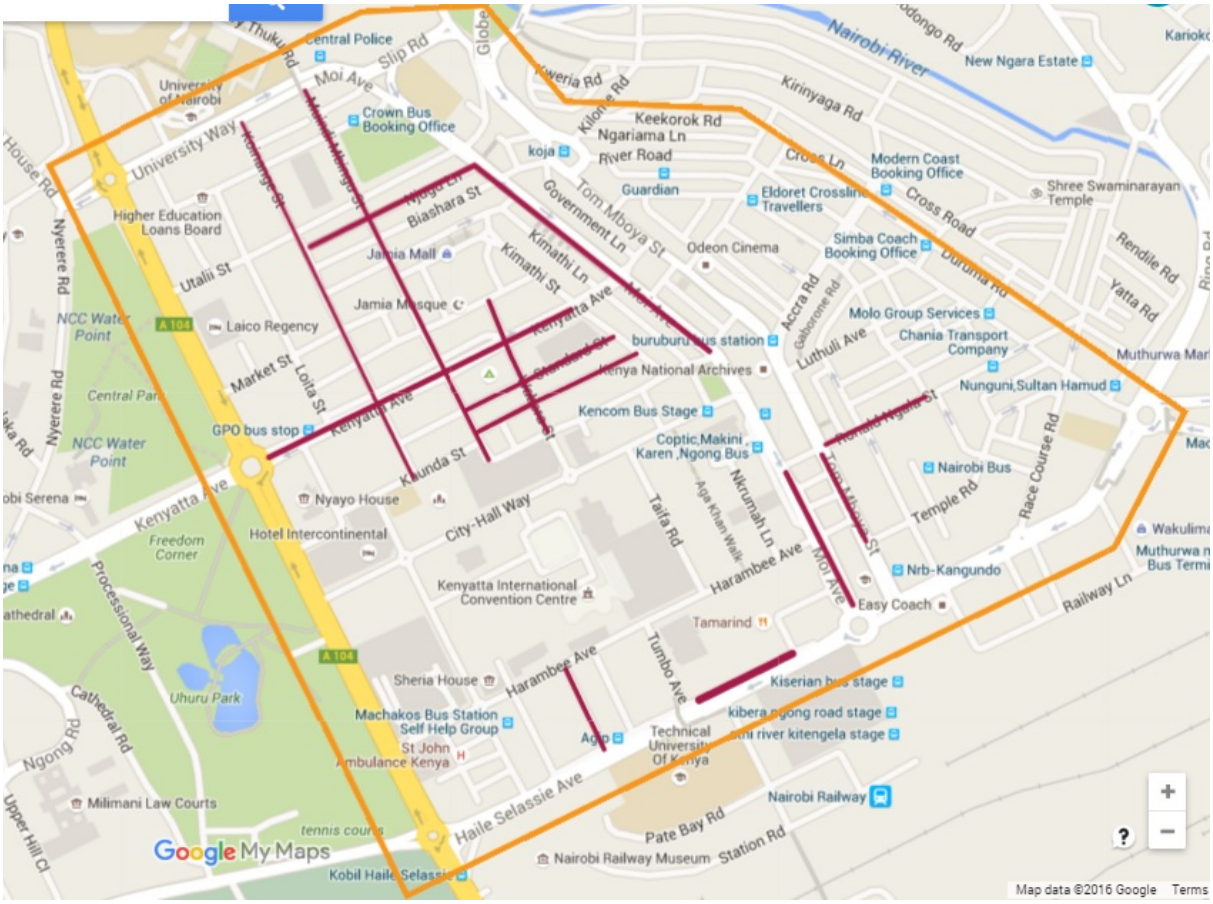

Figure 8: Streets covered in the turnover survey.

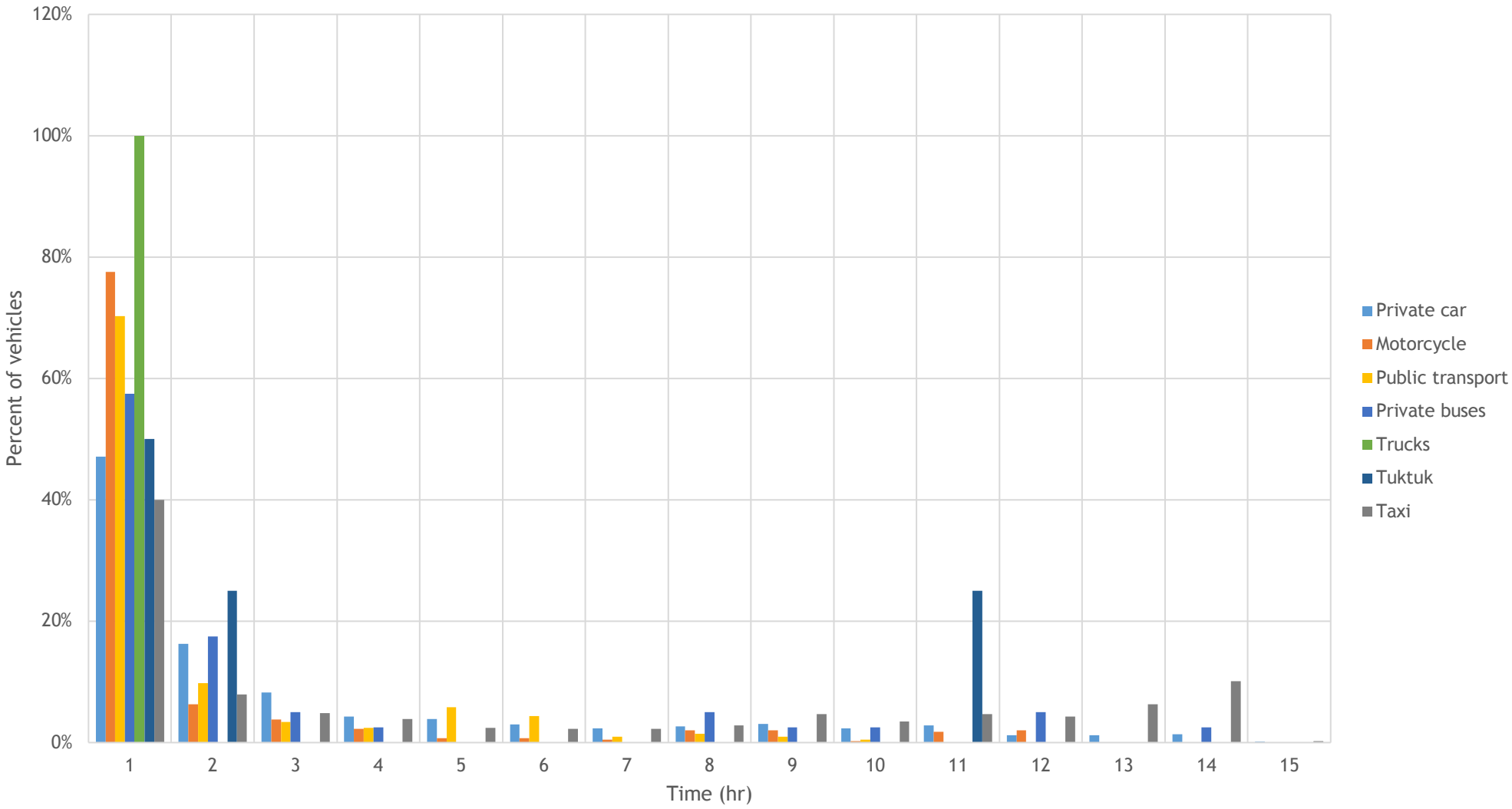

Figure 9: Distribution of vehicles by parking event duration.

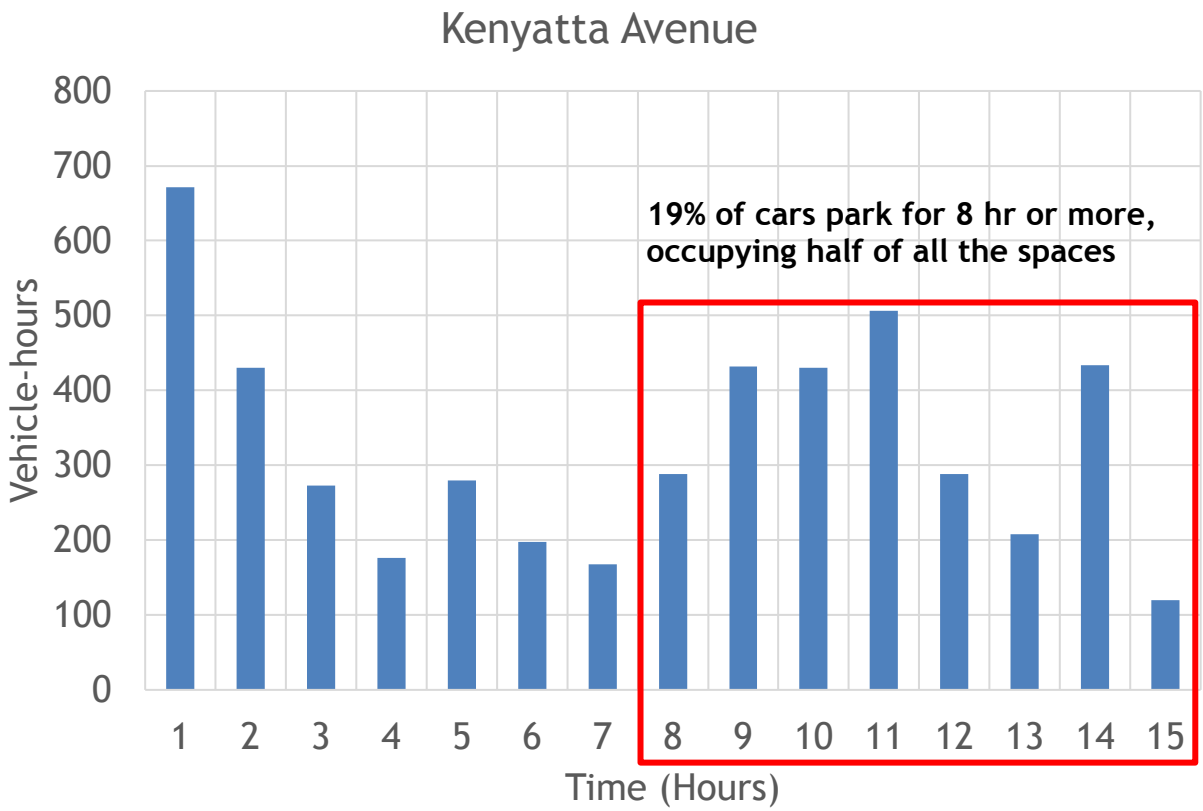

Figure 10: On Kenyatta Ave, a minority of vehicles occupy most of the parking spaces. A similar pattern is found on other major streets in the CBD.

4. Findings

The following preliminary conclusions can be drawn from the results.

4.1 BRT and parking

The analysis revealed that some proposed BRT corridors, such as Haile Selassie Street, experience low occupancy levels. In these locations, substitution of parking in favour infrastructure for BRT, along with complementary walking and cycling paths, may have a minimal impact on parking activity. In other locations, such as Moi Ave and Kenyatta Ave, on-street occupancy levels are higher, but there is significant surplus capacity in off-street lots that could absorb most of the vehicles parked on these stretches.

4.2 Need to strengthen the parking management system

Ongoing monitoring and analysis is a crucial component of an efficient parking management system. Though the current parking system offers some IT-based elements such as electronic payment options, steps can be taken to tighten the parking system through:

- Real time capturing of GPS locations and registration numbers of vehicles to get a sense of the level of parking activity along each street;

- Automatically penalties for defaulters as opposed to the current system that leaves fining to the discretion of the parking attendant;
- Logging of repeat defaulters and bylaw amendments to allow the government to charge fines in arrears;
- Introduction of service level standards to ensure that parking attendants check a minimum number of vehicles each day to reduce the number of defaulting vehicles that go unchecked; and
- Real-time monitoring of parking attendants' positions using GPS to ensure they are stationed at the appropriate location.

4.3 Demand-responsive parking fees

Setting parking fees so as to achieve an occupancy rate of 80 to 90 per cent helps strike a balance between efficiency and ease of finding a space. Occupancy rates are above 90 per cent on many on-street parking spaces, whereas off-street lots experience markedly lower occupancies. The typical cost of parking in off-street lots is around KES 400, which is higher than the KES 300 charged for on-street parking, suggesting that it may be desirable to increase fee levels for on-street parking.

In many instances, parking demand management through price-based regulations helps address imbalances between supply and demand. A strategy that adopts variable pricing on street spaces depending on demand can ensure sufficient availability, improve utilisation, and ensure that that on-street spaces are valued appropriately.

4.4 Use of parking revenues to fund sustainable transport

The adoption of variable pricing could reduce cruising for parking and generate additional revenues that could be reinvested in transport improvements. Such reinvestment is important as it not only builds public understanding and acceptance of the price adjustments but also works to promote sustainable transport. Direct links between pricing and tangible transport enhancements can be through NMT infrastructure improvements to help meet NCC's NMT Policy goal of building 1,000 km of footpaths by 2020.

4.5 Parking lots as multipurpose spaces

Parking spaces can be managed to serve multiple public purposes. For example, several parking lots in the CBD double as recreational or commercial spaces. These include the sunken car park on the Aga Khan Walk, which serves as a skating facility over the weekends (particularly Sundays) and holidays, as well as the Supreme Court car park lot, which doubles as the grounds for a Maasai market on weekends. These uses are approved by the NCC, but due to their temporary nature, they may be overlooked in the planning process. These cultural and recreational areas can serve to provide mixed and changeable uses that stimulate the local economy and facilitate social activity within the city.