Formulation of the Problem of Vehicle Parking in the Central Area of Luanda - Solutions for Intervention

Pascoal Diogo Fortunado

(Pascoalfortunato@gmail.com)

Abstract

Parking is a frequent problem in major world city centres. In Luanda, the problematic of Parking is expressive, especially in the city centre where the Central Business District (CBD) is located. In the last decades an exponential population growth occurred, motivated by the armed conflict the country went through. The demographic growth, the increase of vehicle fleet and the existence of a frail public transportation system created mobility, accessibility, and Parking problems in Luanda. In that context, this dissertation aims for the characterization of Parking's Supply and Demand in Luanda's city centre. Through implementation of inquiries at the parking sites and subsequent destinations, and through the execution of cordon and patrol counts it was verified that private transportation and *candongueiros* (passenger vans used as public transportation) are the primary choice made by the population when commuting to the centre. It was also verified that the main access routes to the centre have reached the maximum flux capacity for which it was dimensioned.

Currently, at mornings, there are entering the city centre just about 59.340 vehicles facing a 18.711 parking spots supply, with a turnover rate of 1.33 vehicles for vacant parking spot, in the central area. This reality causes problems such as chaotic traffic, traffic jams, illegal and abusive parking, difficulties with turnover and with supervision. Enforcement of a management program of parking demand and an efficient public transportation policy are seen as solutions.

Keywords:

Parking, Mobility, Accessibility, Turnover and Transportation.

Introduction

The city of Luanda currently plays the part of Angola's financial, commercial, economic and political centre. In that role, it polarized its economic activities, which drew up the attention of the population of other provinces that saw there a better job and lifestyle opportunity. The exponential population growth recorded in the last decades provoked an increase in mobility, hence the number of vehicles circulating in the city. According to the National Directorate of Transit and Traffic (NDTT) in Luanda just about 1.746.227 vehicles were registered between 2002 and the first trimester of 2015.

Luanda suffers from a great urban pressure, it was dimensioned to receive 500 thousand inhabitants (ANGOP newspaper) but today that number has increased in 6.5 million inhabitants (data from the 2004 census). However, the verified growth in the country, justified by the politico-military stability, has not been accompanied by the road infrastructure development in its multiple roles – traffic outflow, parking, and urban mobility. Specially in Luanda, and with greater incidence in its central area where the city's Central Business District (CBD) is located, due to commuter traffic to the centre which makes that zone's road circulation very heavy.

Therefore, this study aims to characterize the problem of car parking in Luanda's city centre through variables of parking's supply and demand and to identify possible solutions or problem mitigation.

The devised methodology for the development of this study aims for the realisation of the identified goals. The organizational structure of the methodology sets in four stages, or points, as illustrated below (image 1).

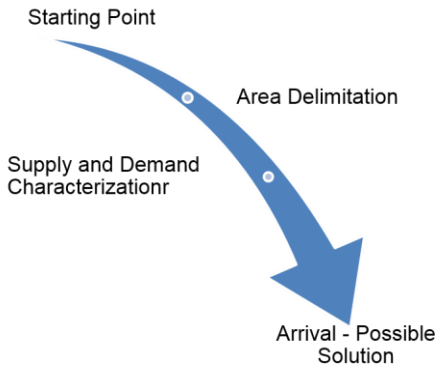


Image 1 - Methodology

The adopted methods for the characterization of parking's supply and demand were developed through data gathering techniques. The inquiry procedures passed by interviews near the parking area and subsequent destinations, through observation of the type of cordon count and of patrol count and interviews with experts and parking facilities managers.

Context

Parking today is regarded as a fundamental instrument when defining urban policies, due to its influence in urban mobility policies, in the dynamics associated to land use – residential, commercial and service areas – and by the involved parties – residents, workers, visitors, managing entities, etc. (IMTT, 2011). Because "the increase in vehicle fleet on major centres, makes clear the negative effects in the road

system and in people's quality of life. Amongst the determined problems it is noticeable the accessibility and mobility reduction, the environment deterioration (pollution), the heavy traffic jams, the traffic accidents and the parking shortage etc." (ANTP, 1997) quoted by (Mello et al., 2011: 40).

In response to the increase in vehicle fleet, the cities adopted actions based on the *predict & provide* strategy, in other words, they tried to provide a solution to the growing parking demand by increasing the supply until the existing demand was satisfied, however, without considering the system's sustainability (Gaspar, 2008).

For instance, this phenomenon is apparent at Luanda's city centre where there is a growing demand in parking time. In response to that need, there is an attempt to increase parking capacity through new infrastructures, which has prompt Individual Transportation (IT) when commuting to the city centre. Therefore, proving that this *predict & provide* policy based paradigm is inadequate since it favours IT, adding to the accessibility and mobility problems (IMTT, 2011).

In that perspective, there is a need to change the paradigm so it contemplates the system's sustainability, accessibility, and mobility policies that translate in a more efficient usage of infrastructures and resources, and in dimensioning parking supply in a way that takes in consideration the more sustainable transportations (public transportation, by foot or bicycle) (IMTT, 2011). This new paradigm points towards the Parking Management Policies (PMP) that contribute for more functional and sustainable cities and providing a better life quality for its population.

City of Luanda

Because Luanda's CBD is located in the city centre, the population needs to commute daily. During the morning the population from the peripheral areas commute to the city centre and in the evening they return home; that commuting process exposes the fragility of urban and Public Transportation System (PTS) of the city.

A state company, the Transporte Coletivo Urbano de Luanda – TCUL (Urban and Public Transportation of Luanda), together with four private companies - MACON, TURA, ANGOAUSTRAL and SGO - comprise Luanda's PTS. There is a small network of conventional taxis in the city; they serve a specific part of the population, generally those who travel to Luanda in business or leisure (José, 2011). According to José (2011), the fragilities shown by the Transportation System (TS), regarding the supply of urban transportation, as allowed for the emergence of a transportation network of collective taxis (*candongueiros*) are responsible for transporting a significant number of passengers, even though their urban interaction is problematic. At the same time, other practices of transportation services emerge, such as the *gira bairro* (passenger vehicles), motorcycles and *kupapatas* (cargo motorcycle); they are responsible for transporting the population commuting to poor accessibility areas.

Area of Study Delimitation

The area of study corresponds to the city's central zone of Luanda, stretching for 8.11km^2. The area of study boundary is based on existing urban areas, as shown in image 2. For this case study, the area corresponds to the black polygon (area limit).

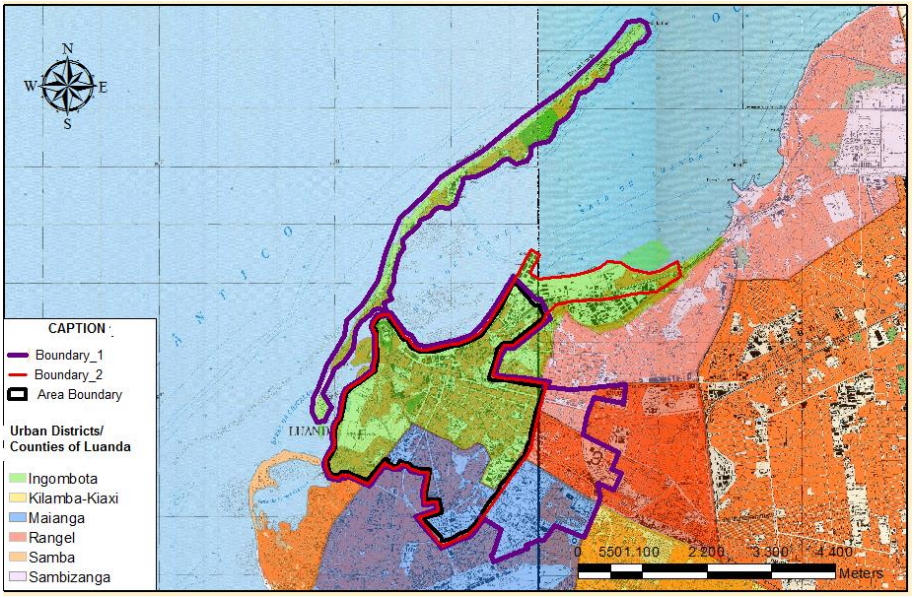


Image 2 -Physical city centre limits (adapted from decree 59/2011)

The study area divides into 7 distinct zones; table 1 shows the relationship matrix used when dividing the zones presented in image 3.

Table 1 - Relationship matrix of the area of study.

Zones	Service	Commerce	Housing	Leisure/Touring
1	●	●	○	●
2	●	○	○	●
3	●	○	○	○
4	○	●	●	○
5	●	●	●	○
6	○	●	●	○
7	●	○	○	○

CAPTION	
Very HIGT	●
Higt	●
Low	●
Very Low	●

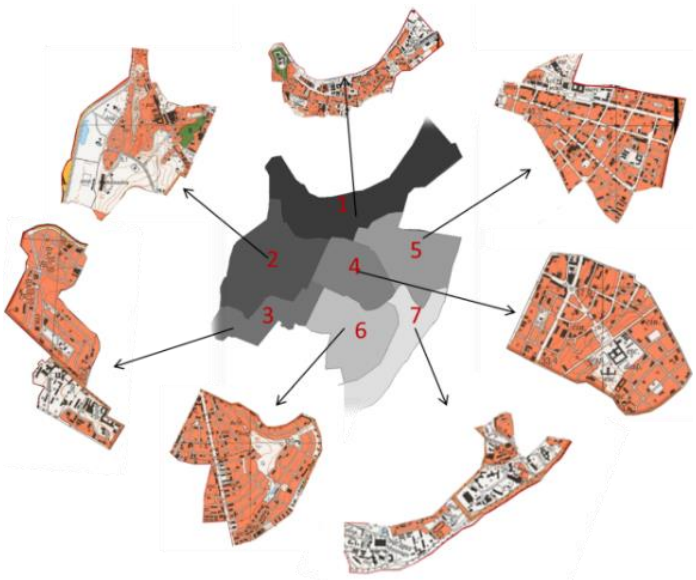


Image 3 - Division of the area of study.

Characterization of Parking Demand

Table 2 - Parking demand typology

Duration	Approximate Term	Examples
Medium Term	1 - 2 Hours	Appointments; Leisure; Other Matters
	2 - 4 Hours	Shopping; Leisure; Touring; Other Matters
Long Term	4 - 8 Hours	Work; Touring
	> 8 Hours	Residents

The inquiries show that from the total of dislocations to the city's centre, about 52% are work related and 26% relate to other matters, as showed in image 4.

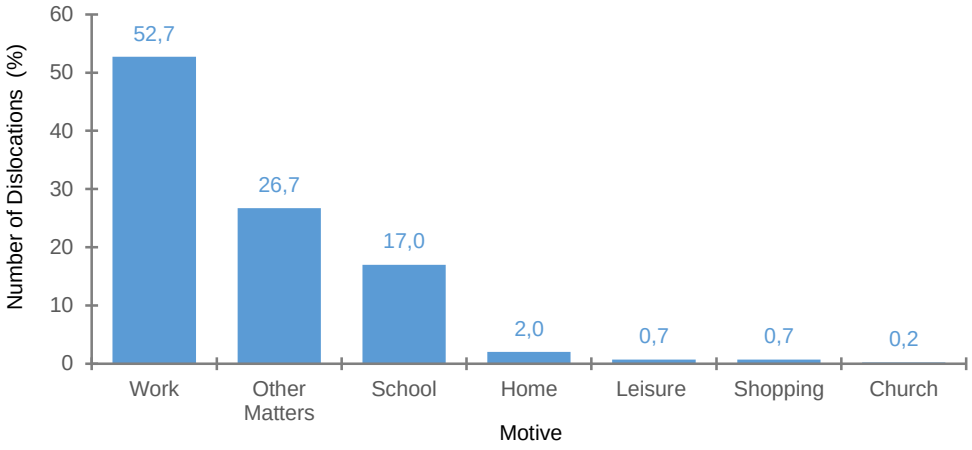


Image 4 -Motives for travelling to the city's centre.

The journey to the city's centre, with motives showed in figure 4, was made using TC and TI. The most chosen transportation, when commuting from the peripheries to the centre were collective taxis (*candongueiros*) and cars, as showed in image 5. These results indicate the vital importance of the *candongueiros* in Luanda's city mobility.

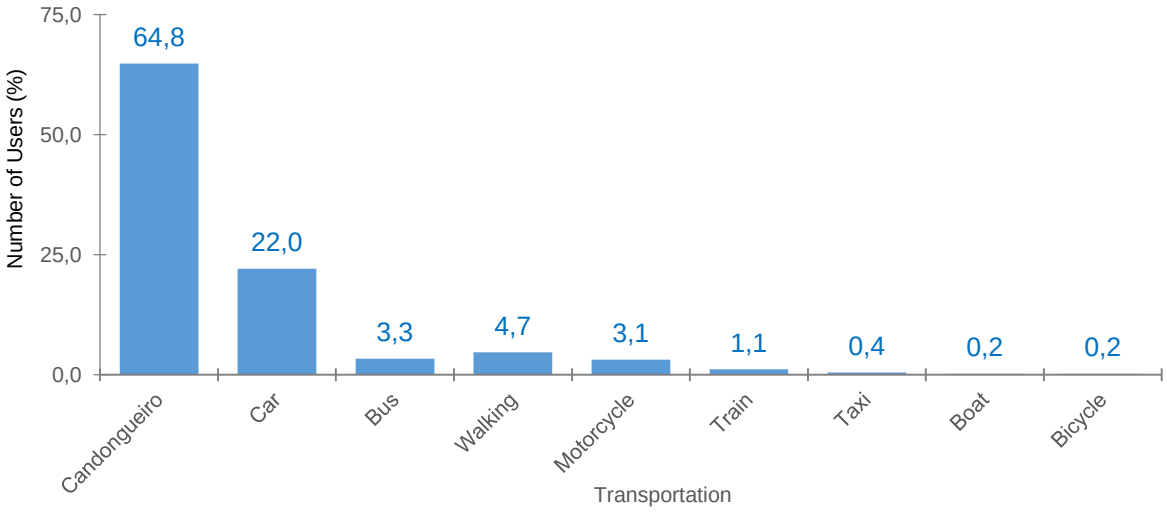


Image 5 - Chosen transportation when travelling to the city's centre.

The majority of the inquired population was satisfied with the level of transport service of the TC in the centre, as illustrated in image 6.

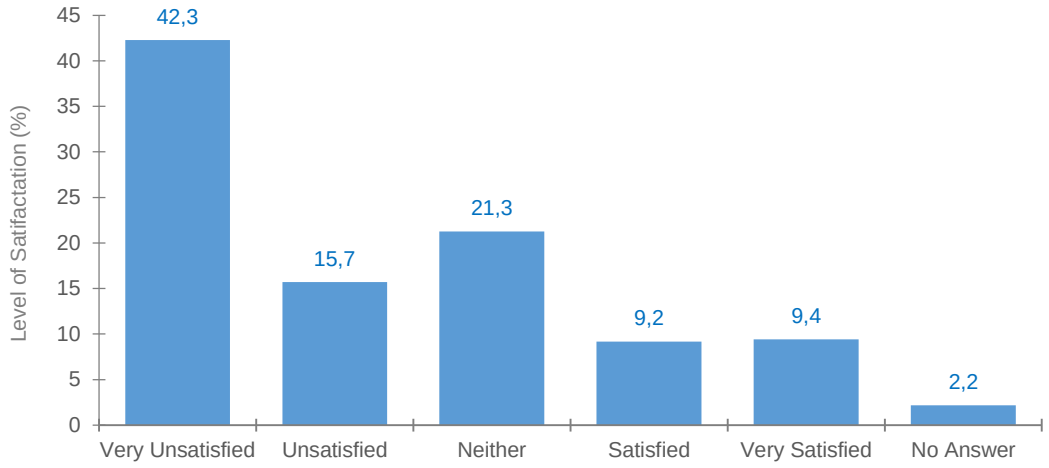


Image 6 – Level of satisfaction with Collective Transportation

Usually, commuters that arrive very early, and use the vacant spots for a long period occupy the majority of vacant parking spots in the centre. Image 7 shows the duration (in minutes) of parking demand according to working days and weekends.

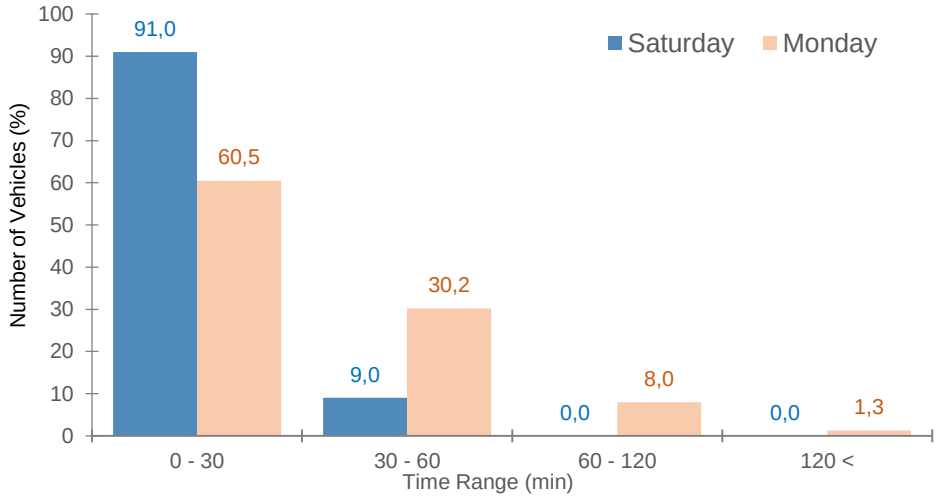


Image 7- Duration of parking demand according to working days

It is difficult to find a parking spot in the centre, and TI users are unhappy with the parking services (image 8).

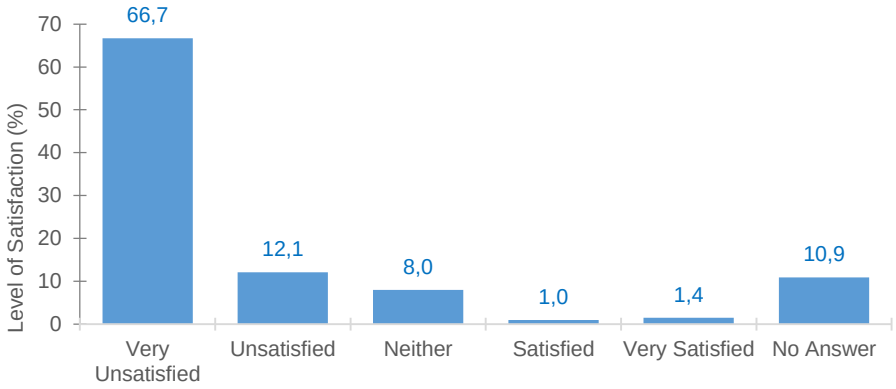


Image 8 – Population's level of satisfaction relating city centre parking.

Cordon Count

A cordon count was made in the five main arteries that reach the centre, which verified an increase in the capacity ratio of traffic volume in comparison with 2007, and many of these roads have reached maximum capacity.

Table 3 presents the ratio comparison of traffic volume capacity between 2007 and 2015 in several locations were cordon counting was done.

The cordon counting made clear that many routes that access the city centre have already reached the dimensioned maximum capacity, as illustrated in table 3 and image 11 (in appendix).

Table 3 – Traffic volume capacity ratio (adapted from decree 59/2011)

Cordon	Description	Capacity	2007	2015
C1	Unilateral 2 tracks in each direction	2 000	0.62	0.53
C2	2x2 simple/ with parking in both sides	1 500	0.59	0.64
C3	1x2 simple/ with parking in both sides	1 000	1.26	1.47
C4	1x2 simple/ with parking in both sides	1 000	1.64	----
C5	2x3 duble/ with parking in both sides	3 000	0.71	0.73
C6	2x2 simple/ with parking in both sides	2 000	1.05	----
C7	2x2 duble/ with parking in both sides	2 000	0.83	1.22

Turnover Rate

The turnover rate of the study area is about 1.33 vehicles for parking spot. Conversely, the distance people are willing to walk from the parking lot or taxi stop to their destination and vice-versa is about 650 meters, which corresponds to 8 minutes.

Parking Supply Characteristics

The typological parking paradigm in the centre is of medium and long term, as presented in table 4.

Table 4 – Current parking paradigm.

Zones	Parking Location	Duration	Access	Fee
Whole Area	Road	Medium/long	Free	No charge
Whole Area	Parking Facility	Long	Free	No charge
1, 2 e 7	Parking Facility	Long	Free	High fee and increases with duration

Number of Parking Spots

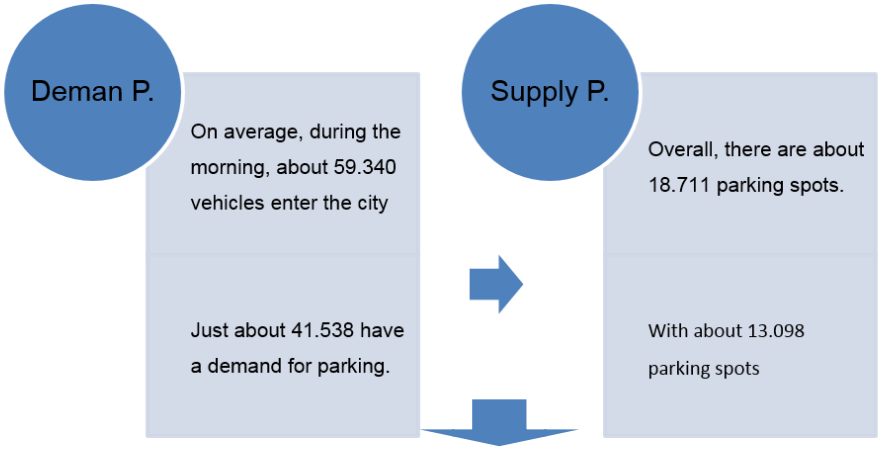
The area of study has about 18.711 parking spots, 15.120 of those are located on the road, and 3.591 are on parking facilities (table 5).

Table 5 – Area of study routes representation.

Zones	Parking	Road	Total
(1) Historic Centre	2940	4054	6994
(2) Cidade Alta	338	209	547
(3) Bairro Azul		1005	1005
(4) Mutu		2943	2943
(5) Kinaxixi	100	3016	3116
(6) Maianga		2896	2896
(7) Gika	213	997	1210
Total	3591	15120	18711

Key Issues Identification

On average, during the morning, about 59.340 vehicles are entering Luanda's city centre on a daily basis (70% of those are TI). The morning demand for parking is 41.538 (70% of total entries), for a supply of 18.711 parking spots, of which only 13.098 are available (70% of total), because 30% are occupied by residents. The supply/demand relationship translates in 300 vehicles per 100 parking spots, without considering the number of spots occupied by residents. In view of this situation, no parking problems would be abnormal. Image 9 presents a diagram of the parking issues.



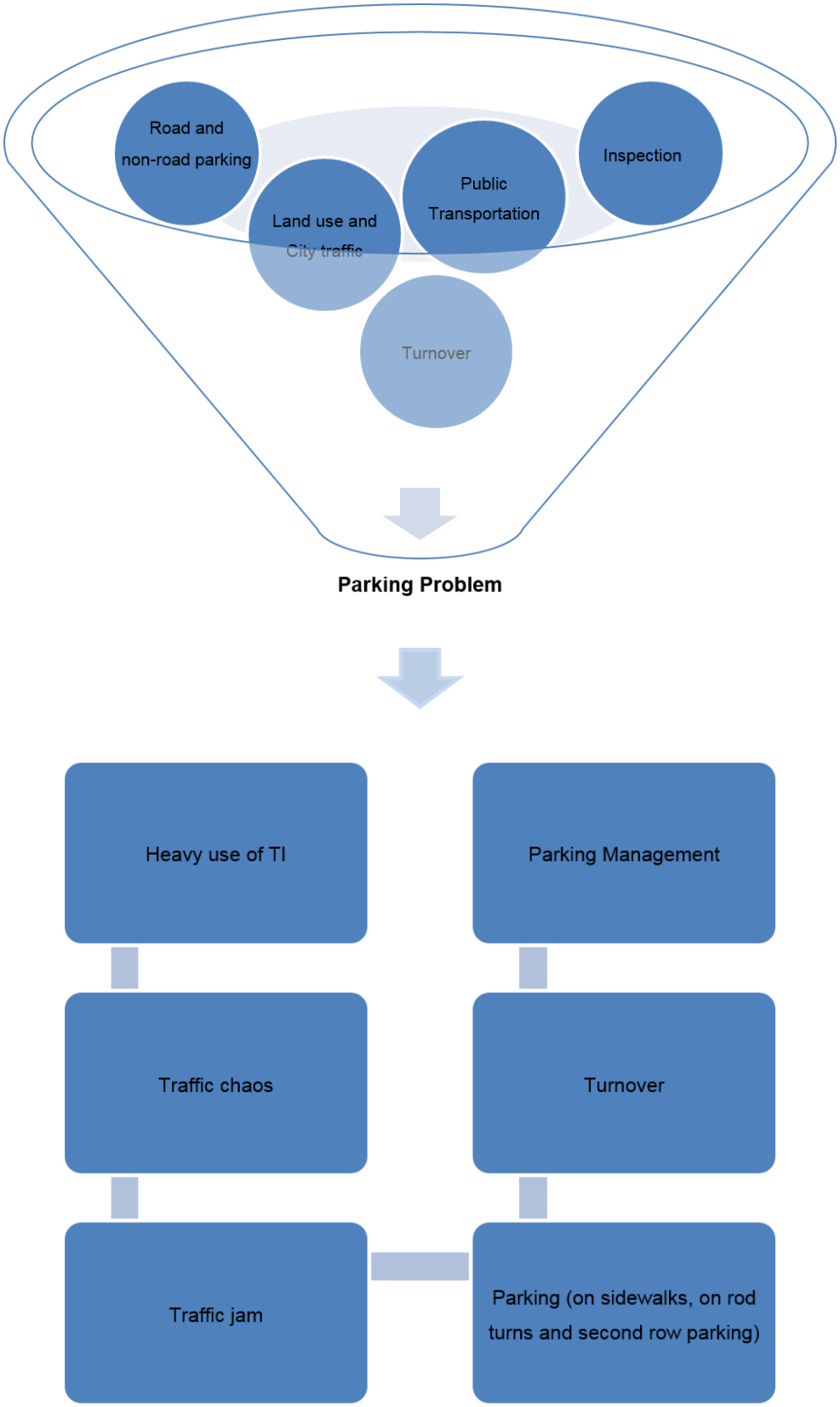


Image 9 – City centre parking situation diagram.

Intervention Proposal

Transportation: investing on taxis (*candongueiros*) by building small support infrastructures (stops and terminal stations); reinforcing the existing policies to improve ST; implementing a modal interface system that offers mobility alternatives from peripheral, semi-peripheral and central areas (image 12 in appendix). *Park & Walk* enforcement at the city centre, or surrounding areas would allow users to leave their vehicles closer to their destined location (image 13 in appendix).

Turnover: the solution to the turnover issue goes by enforcing a parking fee policy at the city centre with a 3-class division – higher parking density zone (class A), medium parking density zone (class B) and low density parking zone (class C). Definition of class should relate to the intended turnover for each zone, as illustrated in image 14 (in appendix).

Parking: adopting management measures in which road-parking fee is higher than the non-road parking fee in order to unburden the routes (in case of fee enforcement), reasonably increasing the number of parking facilities (park & walk) based on a parking management plan different than the previous *predict & provide* paradigm.

Inspection: establishing an independent supervising entity solves this issue. Image 10 is diagram representing an intervention proposal to the parking problem.

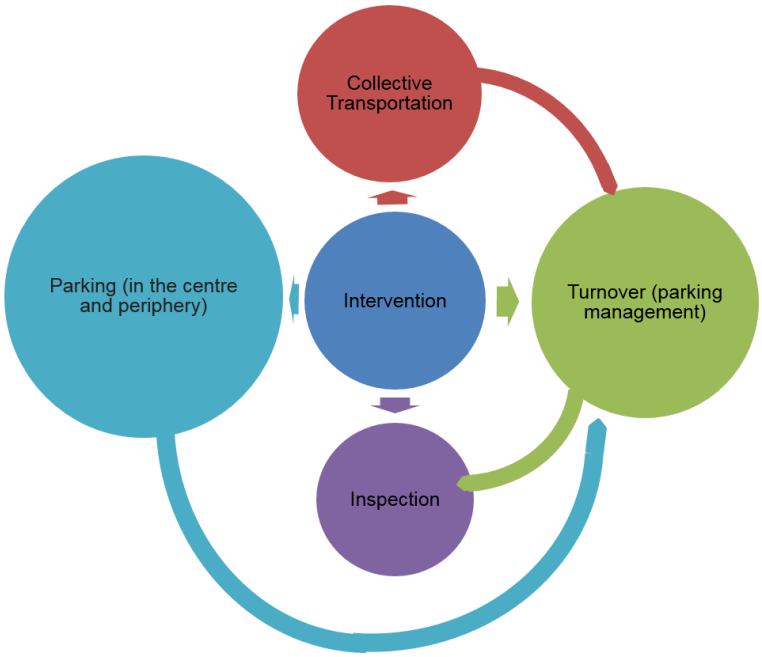


Image 10 – Area of study intervention diagram.

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Appendix

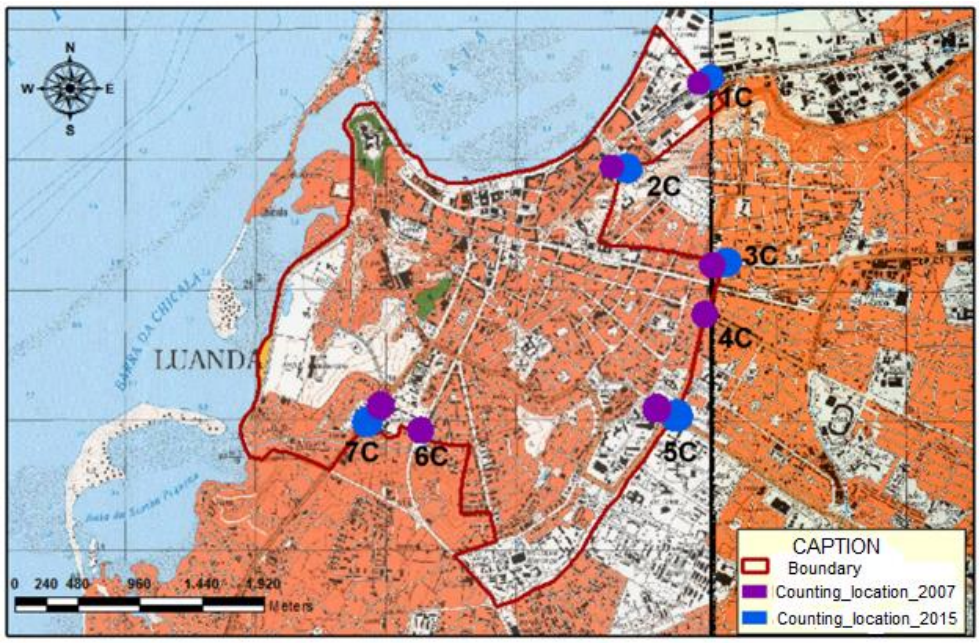

Image 11 – Cordons location.

Image 12 – Interface installation zones (adapted from Luanda's Transportation System –Program, Terming and Infrastructures).

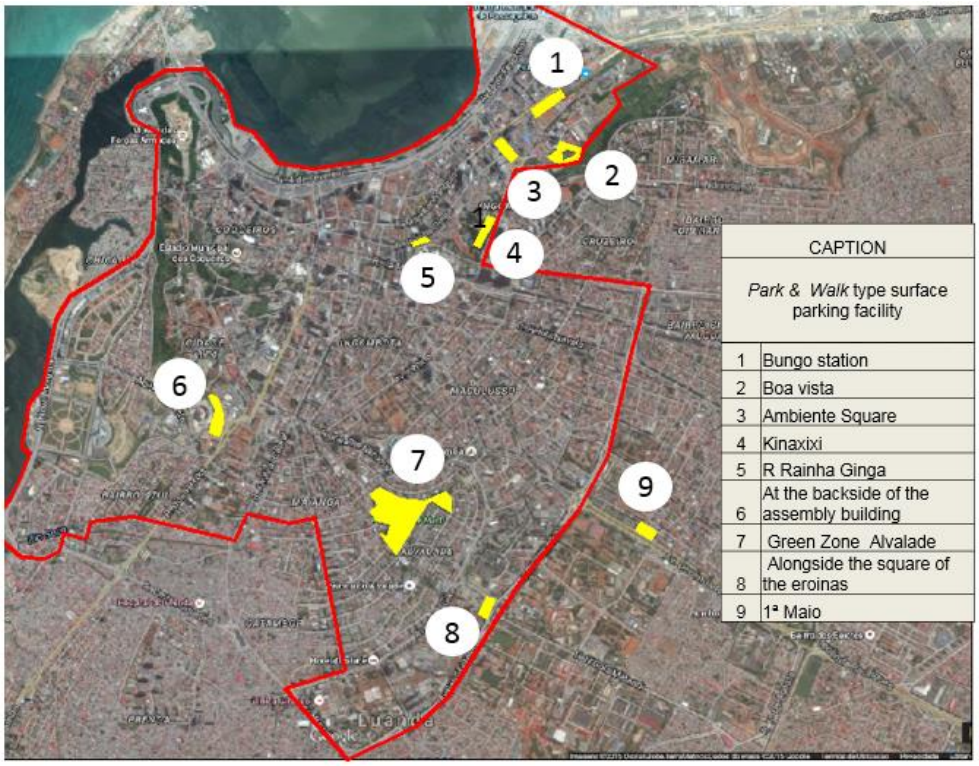

Image 13 – *Park & Walk* installation zones (adapted from Luanda's Transportation System –Program, Terming and Infrastructures).

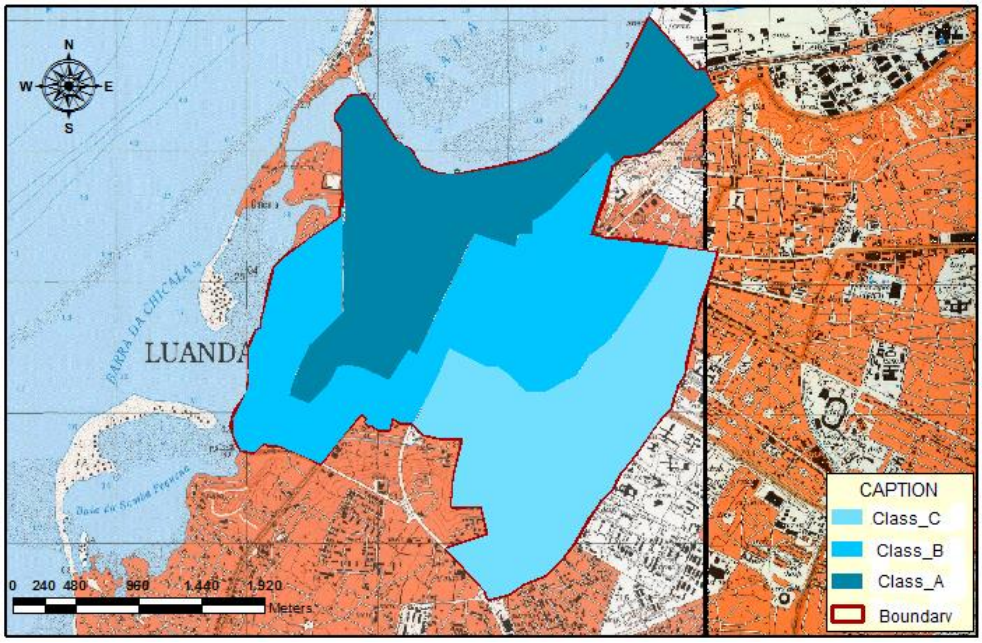

Image 14 – Area of study boundary.