UNIVERSITY OF NAIROBI

SCHOOL OF ENGINEERING

EXPLORING THE POTENTIALS OF A GIS-BASED STREET ADDRESSING SYSTEM IN THE MANAGEMENT OF LAND RATES.

CASE STUDY: MACHAKOS TOWN

A Project submitted in partial fulfilment of the requirements for the Degree of Master of Science in Geographic Information Systems, in the Department of Geospatial and Space Technology of the University of Nairobi

BY

MUINDE SAMMY MUTINDA

F56/80929/2015

AUGUST, 2017

DECLARATION

I, Muinde Sammy Mutinda, hereby declare that this project is my original work. To the best of my knowledge, the work presented here has not been presented for a degree in any other Institution of Higher Learning.

…….. …… ……

Name of student Signature Date

This project has been submitted for examination with my approval as university supervisor.

…..…… ..…… ……..……

Name of supervisor Signature Date

ACKNOWLEDGEMENTS

First of all, I would like to express my sincere gratitude to my supervisor Mr. Jasper N. Mwenda of the Department of Geospatial and Space Technology, University of Nairobi for his instrumental guidance, and encouragement that has ensured smooth progress of the project.

Likewise, I would also like pass my earnest appreciation to the staff and fellow students in Master of Science in Geographic Information Systems, Department of Geospatial and Space Technology of the University of Nairobi for their assistance during this study.

DEDICATION

I dedicate this work to my dad, mum, siblings and close friends. Deprived of their support, this journey would not have been possible.

ABSTRACT

A study on street addressing system reveals that there are several benefits associated with the system. In fact, it is one of the most feasible systematic efficient approaches for managing properties and locating places. A sizeable sample of planning authorities in developed countries have applied successfully street addressing to manage cities, towns and urban areas. Addressing allows for effective revenue management, ease of navigation (way finding), identification of various properties including business location, provision of utilities and ease of circulation of emergency services such as ambulances, fire and security services among other benefits. However, regardless of its numerous potentials, there has been little effort to apply this concept in revenue management by the County Governments in Kenya. Land rates are the most important sources of local revenue for the devolved government. This is because land is immobile therefore rates from land are a certain sustainable source.

Over the past five years, various counties have had challenging encounters in the management of land rates which have made the rating authorities issue waivers through print and visual media as a measure to lure defaulters in order to pay their arrears. This is an indication of management challenges perhaps due to lack of adequate information to make important managerial decisions and incorporation of technologies to track defaulters. About fifteen per cent of national budget funds is shared among 47 counties. These monies end up either in individual pockets, mismanaged and settling recurrent expenditure, leaving counties with the option of depending on locally generated revenue (inadequate) for development.

The study focused on codifying streets and assigning addresses to land parcels (unique identifiers) within Machakos town (study area), did a comprehensive land rates inventory register using a GIS-based street addressing in the study area, and designed a GIS geo-database of street address index and land rates inventory. All this was done with the overall objective of designing a GIS-based Street addressing system and demonstrating its potentials in the management of land rates within the study area. Addressing helps in precise location of properties. Indeed, addition of the geo-spatial information component to the properties will enhance Machakos rating department and County Government at large to collect more rates through an improved revenue management system. The expandability and sustainability nature of GIS-based addressing system should allow Machakos County also to roll out the system to other towns and urban centres to improve on service provision, development and urban planning in the County. This system can be replicated in other counties as well.

TABLE OF CONTENTS

DECLARATION ..... **i**
ACKNOWLEDGEMENTS ..... **ii**
DEDICATION ..... **iii**
ABSTRACT ..... **iv**
List of Figures ..... **vii**
List of Tables ..... **vii**
List of Acronyms ..... **viii**
CHAPTER 1: INTRODUCTION **1**
1.1 Background 1
1.2 Problem Statement 2
1.3 Objectives 3
1.3.1 Overall Objective 3
1.3.2 Specific Objectives 3
1.4 Justification of the study 4
1.5 Scope of work and limitations of the study 5
1.6 Organization of the report. 5
CHAPTER 2: LITERATURE REVIEW **6**
2.1 What is A Street Addressing System 6
2.2 Importance of Street Addressing System 6
2.3 Historical Evolution of Street Addressing. 7
2.3.1 The Origin about 18th Century 7
2.3.2 Addressing in the Nineteenth century 8
2.3.3 Addressing in the Twentieth Centaury 8
2.3.4 Addressing In the African Continent 8
2.3.5 Street Addressing In Kenya 9
2.4 The Process of Street Addressing 9
2.4.1 Up to date Base Map development 10
2.4.2 Street Codification 10
2.4.3 Methodology Guidelines for Street Addressing 11
2.4.4 Addressing Physical Properties 11
2.5 Land and Property Rates 13
2.6 Street Addressing System and Revenue Management 16
2.6.1 Refining efficiency of the existing rating system 16
2.6.2 Restructuring the Land Rating System 16

2.7 Geographic Information System (GIS) 17
2.7.1 Historical Evolution of GIS 18
2.7.2 Relationship of GIS and Street addressing system 19
2.8 Evaluation Factors for GIS-based Street addressing system 19
CHAPTER 3: MATERIALS AND METHODS 21
3.1 Area of Study 21
3.2 Methodology 21
3.2.1: Preparation of Datasets 23
3.2.2: Codification and Addressing 27
3.2.3: Building Geo-Database 30
CHAPTER 4: RESULTS AND DISCUSSIONS 34
4.1 Existing Rating Situation in Machakos Town. 34
4.2 Land Rateability Status 35
4.3 Street Addressing and Land use inventory 38
4.4 Land Rates Payment inventory 40
4.5 Street Address Index Register 41
4.6 Summary of Study Findings 45
CHAPTER 5: CONCLUSION AND RECOMMENDATIONS 46
5.1 Conclusion 46
5.2 Recommendations 47
REFERENCES 48
APPENDICES 50
Appendix 1: University Research Introduction Letter 50
Appendix 2: Comprehensive Street Address Index Register for the study area 51

List of Figures

Figure 1: Benefits of Street Addressing 6
Figure 2: Numbering Systems for Street Addressing 14
Figure 3: General methodology Overview 21
Figure 4: Geographic location Map of Machakos Town CBD (study area) 22
Figure 5: Comprehensive GIS Modelling Methodology 23
Figure 6: Working base map for developing a street addressing system 26
Figure 7: Reference Point and Digitizing streets 27
Figure 8: Conceptual design of developing addressing localities 28
Figure 9: Map on Street Coding in the Study Area 29
Figure 10: General Conceptual database design model 30
Figure 11: Conceptual idea in addressing plots 31
Figure 12: Creating Personal Geodatabase 32
Figure 13: Designing relational tables 33
Figure 14: Map on Ratebility Status of the plots in the Study area 36
Figure 15: Street Addressing and Rateability status query 37
Figure 16: Sample query of street addressing and land use inventory 38
Figure 17: Map on Street Addressing and land-use inventory for the study area 39
Figure 18: Land rates payment query 40
Figure 19: Map on rates payment-per-plot inventory 42
Figure 20: Sample Street Address and Index Map 44

List of Tables

Table 1: Significance of Street Addressing to various users 7
Table 2: Decametric Numbering System 13
Table 3: Data Sources 24
Table 4: Hardware Components for the study 24
Table 5: Software components for the study 25
Table 6: Data preparation procedures 25
Table 7: Sample of Street Address Index for management of land rates for Machakos CBD 43
Table 8: Summary of study findings using objectives 45

List of Acronyms

CAK – Communications Authority of Kenya
CBD – Central Business District
ESRI – Environmental Systems Research Institute
FIG – International Federation of Surveyors
GIS – Geographic Information Systems
GOG – Government of Ghana
GOK – Government of Kenya
MCG – Machakos County Government

CHAPTER 1: INTRODUCTION

1.1 Background

Streets are important structuring elements in the urban fabric. There are several purposes of streets in an urban setup. Being an integral part of towns and urban areas, the various functions of a street comprise routes of access to properties and places, corridors of movement for people, goods, and services, public space where people can work, rest and socialize. Streets also act as 'breathing spaces' (lungs) as they offer ventilation function among other functions. All withstanding, locating and access to various properties and buildings, is the primary function of a street. Streets dictate the speed at which an urban area develops.

Today, there are speedy urbanization trends worldwide. The escalated urbanization drifts are further magnified across the developing countries. In fact, a research by World Bank found out that 54% of the global population live in urban areas. This rapid urban transition poses an opportunity as well as a management challenge for the local planning authorities. Urban areas represent a pool of resources that focus much of the area's physical, financial, and human capital. Street addressing is one of the strategies that planning authorities in developing countries can deploy to sort out the disarrays that come with urbanization and transform them into opportunities. It has worked as a ready solution in many cities that deal with similar rapid development without a corresponding growth in the supporting infrastructure. (World Bank, 2015)

The origin of street addressing can be traced back to the European Countries and United States in the 18th century where it was based on house numbering scheme generally whose main objective was to determine the distribution of property in the city rather than for the purposes of the organization. Later on, addressing was adopted and implemented other parts of the world to aid in administrative tasks and of services such as postage. To date, street addressing has developed to a powerful management tool successfully being applied by planning authorities in different developed countries (Farvacque-Vitkovic, et al., 2005).

The devolved governments in Kenya depend on the funds allocated them by the Central Government for settling recurrent expenditure and management of County infrastructures. However, these monies are usually not sufficient to ensure efficient and effective service delivery and maintenance of local facilities, therefore embarking on measures to generate more revenue. One of the generated revenues County Governments is through land/property rates. By definition, land/property rates are charges/taxes imposed on land based on the trending

market values and any additional improvements there on. Bird and Slack (2002) notes that, taxes collected on land/properties are appropriate and very important sources of incomes for Local Governments because land is fixed.

Street addressing is one of the most feasible systematic efficient approaches of managing properties and locating places. (Farvacque-Vitkovic, et al., 2005), describes street addressing as an exercise that makes it possible to geographically locate a plot or residence, by assigning an address using a system of maps and signs that give the numbers or names of streets and buildings. An addressing system is, therefore, an important element of place organization. In this respect, addressing system is a primary foundation for well-organized and accountable maintenance and improvement of urban and public affairs. It also forms a valuable and efficient urban management tool in the provision of goods and services for urban areas and their environs.

Indeed, advancement in mapping technology has revolutionized how we think about locating places. From the above aforementioned definition, there is a technical GIS-based mapping approach to street addressing that goes beyond just numbering buildings and the "political" assigning of street names practiced in most African developing countries. All withstanding, principal merit of a street addressing system is totally based on mathematical logic and can, therefore, be automated using GIS technology especially with the growing technological awareness within the country. Street addressing system has been implemented successfully by developed countries to manage revenues, public service provision and general management of urban areas.

1.2 Problem Statement

Following the Kenya general election in March 2013, the County Governments were given full powers functions and responsibilities by the Constitution of Kenya (GOK, 2010). Various functions of the Central Government were decentralized to the Counties. Urban planning and management of local revenue was one of the devolved functions (GOK, 2012). However, County urban planning authorities in most of the counties inherited an archaic system for revenue management system characterized by limited capacities in identification, collection, appropriate and effective utilization of the local revenue to deliver services to the public. Land/property rates are one of the key and effective revenues for the counties. Urban planning authorities require these monies in order to perform their functions effectively.

Drawing from experiences of various County Governments over the past years, there has been challenges in management of rates hence issuing waivers through print and visual media as a measure to lure defaulters in order to pay rates. This indicates management challenges perhaps due to lack of adequate information to make important managerial decision. Fifteen percent of the national budget funds is shared among 47 counties. However, as earlier mentioned most these funds end up mismanaged and settling recurrent expenditure, leaving counties with the option of depending on locally generated revenue (which are inadequate) for development agenda. Despite the revenue management challenges, land taxes are a guaranteed source of revenue since land is immovable.

A GIS-based street addressing system is an important contributor to the geo-spatial industry. It helps in locating plots/properties (even without physically visiting the places) by providing geospatial attributes of properties hence a vital tool in revenue management. In management of rates, GIS-based street addressing offers comprehensive and reliable information, which is important for planning and decision-making. Without an identification system, planning authorities in the counties would have limited capacities to manage local revenue in terms of collection, appropriate and effective utilization of the revenue. Like most urban areas in Kenya, Machakos town lacks accurate street addressing system and largely depends on descriptive addresses (locating places using main landmarks such as within bus station, in the market, next to governor's office and so on) that have proved confusing, time wasting and inefficient over time. Introduction and application of a GIS-based street addressing system in collection and management of revenue (especially land rates) will definitely maximize efficiency of the entire revenue management operationalization.

1.3 Objectives

1.3.1 Overall Objective

The main objective of this project is to design a GIS-based Street addressing system and demonstrate its potentials in management of land rates within the study area.

1.3.2 Specific Objectives

1. To codify streets and assign addresses to land parcels/plots (unique identifiers) within the study area.
2. To do a comprehensive land rates inventory register using a GIS-based street addressing in the study area.
3. To design a GIS geo-database of street address index and land rates inventory.

1.4 Justification of the study

Street addressing system has a number of benefits. It is a tool used successfully by many planning authorities in developed countries to manage cities, towns and urban areas. It allows for effective revenue management, ease of navigation (way finding), identification of various properties including business location, provision of utilities and ease of circulation of emergency services such as ambulances, fire and security services among other benefits. However, regardless of its numerous potentials, there have been little efforts to apply this concept in revenue management by the County governments in Kenya.

The County rating authorities inherited manual and archaic system (from the previous old municipal regimes) to collect revenue and provide services. Over recent years and with continued growth the urban areas, these systems have proven inefficient. This fact is amplified by continued plea and issuance of tax waivers to defaulters by a number of County Governments. Subsequent annual auditor's reports for the Kenya Counties (including Machakos County) have shown a massive loss of County local revenue from tax defaulters. For instance, in 2015/2016 fiscal year, only 9 out of 47 counties collected their minimum local revenue collection target, one of the main factors attributed to lack of physical addressing system of properties (GOK, 2016). Machakos County did not optimize its target revenue to be collected. This fact has invoked pursuit for solutions to maximize local revenue collected from the planning authorities.

Land/Property Tax is one of the most vital sources of revenue for Machakos and Kenya at large. The highest percentages of land/property rates are collected from towns and urban centres. Revenue generated from local sources is used to provide public services and supplement revenue allocation from the Central Government. Sufficient awareness on the application of GIS-street addressing system to manage revenues from land and property rates by the planning authorities will improve how they manage the towns and urban areas within their jurisdiction. Contrary to the excel and receipt system used in Machakos County, street addressing revenue management system will ensure ease tracking of rates defaulters because of the geo-spatial details that allows the system to precisely locate plots using addresses and coordinates systems

1.5 Scope of work and limitations of the study

This project aims to demonstrate the potentials of application of a street addressing system in management of land rates (as a component of local revenue). ArcGIS and QGIS will be the main software programs used to develop a digital street addressing system with a geo-database, which will be used as a model tool for Machakos town in maximizing land rates and revenue collection, public service provision and general management of towns and urban areas. In addition, it will allow public in way finding, and fast accurate location of places.

A section of Machakos town CBD (about 0.6 km^2) will be the focus of the study and will be used as a model area/site to demonstrate how GIS-based street addressing system can be applied, updated and expanded to other areas in management of land rates. The output of this project can be replicated by other counties.

1.6 Organization of the report.

This report comprise of five chapters. Chapter one of this project gives the study background, introduces the problem statement, describes the study's objectives as well as justification for the study. Chapter two presents review of literature covering various aspects of street addressing, GIS and land rates. Chapter three presents the study methodology for developing a GIS-based street addressing system and the processes used for data collection and analysis. Chapter four discusses the results and findings of the research study focusing on answering the study objectives. Chapter five charts out conclusions from the findings and discusses the several recommendations for the study.

CHAPTER 2: LITERATURE REVIEW

2.1 What is A Street Addressing System

Street addressing is an exercise that makes it possible to identify the location of a plot or dwelling on the ground, that is, to "assign an address" using a system of maps and signs that give the numbers or names of streets and buildings. (Farvacque-Vitkovic, et al., 2005). Another definition by Anon (2005) describes street addressing as a locational identification comprised of a systematically determined number, a road identification, and a locality identification by (Anon., 2005)

2.2 Importance of Street Addressing System

Street addressing is both an historical and a spatial designation. According to Adebanwi (2012), street naming calls consideration to such practices as important cultural and political grounds for understanding socio-political processes (Adebanwi, 2012). As earlier mentioned, street addressing, has several benefits to different sectors and to extension, the geo-spatial field. Williams (2014) noted that commemorative street naming is both an historical referent as well as a spatial designation. Property-numbering system makes it easier to find unfamiliar places and lessen confusion (Williams, 2014). Locally, in an urban set-up, street addressing will play a significant role in various users. Below, figure 1 shows some of the users to benefit from street addressing.

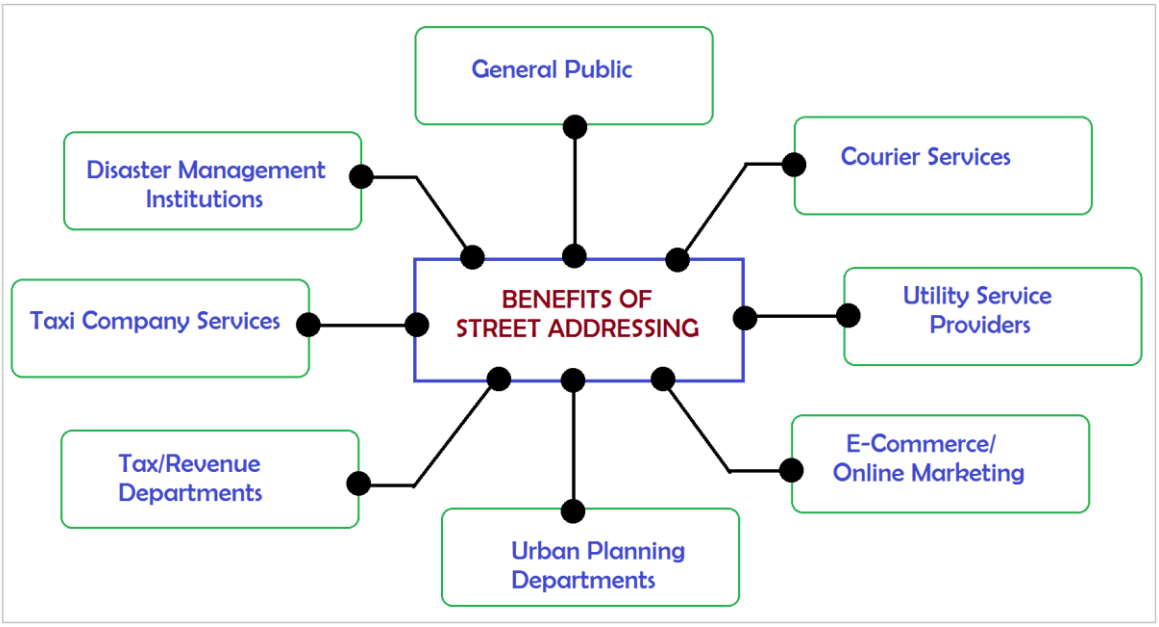


Figure 1: Benefits of Street Addressing

Table 1: Significance of Street Addressing to various users

User Category	Benefits/Significance
A. General Public	– *Ease and time saving in way finding and locating places*
B. Disaster Management Institutions *e.g Fire, accidents, security*	– *Speedy response to emergency incidences*
C. Taxi Services *e.g UBER taxi services*	– *Ease and time saving in navigation in collecting and dropping clients*
D. County Tax/Revenue Department	– *Maximization of tax collection and management. Enhanced accuracy in revenue*
E. County Urban Planning Department	– *Management of urban facilities and infrastructure.* – *Public service provision (on urban planning)*
F. E-Commerce/Online Marketing Platforms *e.g Kilimall, Jumia e.t.c*	– *Improved sales and timely delivery of sales to clients.*
G. Utility Service providers *e.g Kenya Power (KPLC), Water, Internet, sewer, waste collection*	– *Efficient management of Utility networks/facilities.* – *Enhanced utility service fee collection*
H. Courier Services	– *Improved door to door shipping of clients' parcels/letters*

2.3 Historical Evolution of Street Addressing.

2.3.1 The Origin about 18th Century

Street addressing dates back to the 18th Century in Western Europe and the United States. Then, addressing was based on general numbering whose main aim was to regulate the distribution of property in urban areas instead of the organization and planning. Street names in urban areas at this time were generally unwritten, informal, and depicted the roles of different sections of a city, such as a market, bus stops or the location of an important land marks. Roads/streets advanced throughout times and principles became increasingly complex; requiring the specific organisation of roads into a hierarchy, based on size and function. The simple identification and classification of main streets in the colonial cities of ancient Greece evolved throughout the middle ages and developed into today's underlying address infrastructure; composed of a network of many unique physical addresses, each comprising a house number and street name that can be geo-positioned accurately (The University of California, 1992).

2.3.2 Addressing in the Nineteenth century

Notwithstanding the early use of road naming to identify main streets in the previous 18th Century, the above case did not establish address networks. Even though a few primary streets and houses were named, no procedural system existed for naming at the city or national level. For the most part, streets remained nameless and houses numberless. In fact, the first official denomination of city streets by name did not become commonplace until the 18th century in Western Europe, and although some house names were used to locate an exact site, house numbering was only undertaken in the early 19th century. In general, street names developed from informal descriptive references to landmarks to formalized names. Naming increasingly followed a pattern that organized urban space into neighbourhoods and later included the designation of house numbers. The changing concept of public space, a shifting perception of what constituted Government responsibility, and the expanding needs of the newly formed state required consistency and formalization of street naming and house numbering (The University of California, 1992).

2.3.3 Addressing in the Twentieth Centaury

Subsequent years, experienced consistent street name identification all over cities, enhanced spatial organization and contributed to a better foundation for establishing practical management strategies, such as the collection of taxes and rates. As years went by, the implementation of address networks continued to multiply, stretching beyond the mere facilitation of communication and organization to provide the base for social and economic development especially in the face of new challenges to management, such as speedily escalating urbanization trends in cities (The University of California, 1992).

2.3.4 Addressing In the African Continent

Stirred by the colonial masters, French-speaking (francophone) countries were the first to introduce addressing in Africa – for instance, countries such as Chad, Burkina Faso, Guinea, Mali, Togo and Mozambique are the first countries to implement street addressing in Africa. The aforementioned Countries adopted addressing and first implemented the system in their main cities, while street numbers were implemented in zones surrounding the cities (hinterlands), while most of rural areas were neglected. After independence, this colonial system fell into disuse. In 1980's addressing policies began to develop progressively based on systems that identify throughways and house numbers (Farvacque-Vitkovic, et al., 2005).

While Africa's rural areas have traditionally faced political and physical isolation, they are now becoming gradually integrated into national addressing plans that aim to improve communication and services, and enhance national incorporation. Generally, a new wave of awareness about the importance of addresses is far-reaching African nations. Infrastructure improvement, including address infrastructure, has become a priority in most African countries, and for the African Union Commission, which is supporting the creation of guidelines for its members with reference to harmonizing addressing policies.

2.3.5 Street Addressing In Kenya

Street addressing in Kenya was first rolled out in Nairobi City's inner core/ historic Centre layout; patterned after European cities, retains some form of pre-independence street layout, in many cases including street names and signposts. However, because of rapid post-independence city expansion beyond the original fixed urban space, spontaneous residential developments have grown and developed without any urban planning or visionary design to its street layout, devoid of official street naming and house numbering. Major roads are named but usually, people seem to be unaware that they do now have names, because of the lack of signposts.

The Government of Kenya, realizing the need for a comprehensive addressing system, appointed an inter-ministerial National Addressing System task force, charged with the responsibility of fast tracking the development and implementation of an Integrated National addressing system for the Country. The task force was spearheaded by the Ministry of Information, Communication and Technology. The objective of the addressing system was to make it possible for fire, police, and ambulance and public utility companies to locate properties and residences and for speedy emergency response. In 2016, several street addressing projects were initiated in Nairobi City, Thika town, Kiambu town and Machakos town by the Government of Kenya through the Ministry of Nairobi Metropolitan Development funded by World Bank (CAK, 2016).

2.4 The Process of Street Addressing

There are three main stages followed in the process of developing a street addressing system:

1. Development of an up-to-date base map;
2. Street codification; and,
3. Addressing physical properties.

2.4.1 Up to date Base Map development

This entails development of up-to date base map of the area of interest. The primary features of a street addressing base map include:

a) Centrelines of all streets/roads and attributes within area of interest

b) Cadastre layer polygons and attributes of all plots in area of interest

c) Up-to-date of all buildings/properties

d) Zoning addressing localities

To develop an up-to-date base map, an Ortho-rectified image, Topo sheets and Cadastral sheets of the area of interest are required (to generate shapefiles- ESRI format of the aforementioned features)

2.4.2 Street Codification

The direction and structure in which an urban area develops often dictates the framework for street identification. However, it is challenging in sprawling areas where there is little planning initiatives and the developments have assumed an organic way of development. All withstanding, a town or an urban area with well laid-out streets (such as grid-system) offers little challenges. The general principle assumption is that orientation of Streets/roads usually assume a **North-South** direction (N-S) or **West-East** (W-E) direction. Therefore, while performing codification of the streets, there are three very basic steps to follow:

1. First step is to develop a **reference point** within a given area known as **point zero** where all roads confirm/start numbering increasing gradually. Start and end point of every street must also be defined with correct orientation from the reference point.
2. Second step is to classify the developed roads centrelines according to **North-South** direction (N-S) or **West-East** (W-E) orientation.
3. Third Step this entails assigning codes to the streets/roads (unique identifiers). The process of street coding dictates assigning **N-S** streets, **Odd numbers** while **W-E** streets **Even numbers** conforming to **point zero** and **addressing locality zone** limits. On expansive towns where there are several zones, the street codes also pick the zones code/abbreviation by concatenating the two (2) attributes of the two (2) layers.

2.4.3 Methodology Guidelines for Street Addressing

Drawing from a street addressing methodology provided by World Bank developed by below are the guidelines:

a) ***Naming streets.*** This is the most vivid way of identifying streets, and the most commonly used because of its suitability for any street layout. Name selection, however, can pose many problems that unduly lengthen the implementation process. This solution works well when a city evolves slowly enough to allow municipal authorities to devote some time to naming decisions.

b) ***Numbering streets of urban areas with a grid layout.*** This is a more "neutral" system that is easier for public to understand because the streets are arranged a grid-iron network while the addressing is done numerical or alphabetical order from a reference point (point zero).

c) ***Numbering streets of urban areas with Organic (Irregular) layout.*** This system is often used in anticipation of gradual street naming. One way to simplify the process of establishing street coordinates is to group the streets into neighbourhoods or zones, which can then be assigned a sequential number with a prefix that designates the neighbourhood or zone. Most of the street addressing initiatives referred to in this publication have adopted such a system.

d) ***Unidentified streets.*** Developing cities are not the only setting where street addressing initiatives aim to remedy the problem of unidentified streets. High-density housing projects and other residential developments also contribute to the information gap when they ignore surrounding street layouts, add private streets, and identify buildings by numbers or letters rather than by street coordinates. (Farvacque-Vitkovic, et al., 2005)

2.4.4 Addressing Physical Properties

This step entails systematic numbering of properties/buildings to give them a unique identifier in a numbering system simple, clear and easily understandable by target users. According to a manual by World Bank on street addressing system, once the start point of a street has been identified, property/ buildings on the right side of the street are assigned even numbers, while the properties/ buildings on the other side of the street (left) are assigned odd numbers-this is the basic universal adopted system (Farvacque-Vitkovic, et al., 2005).

There are three main property addressing systems that are universally applied in street addressing exercises. They include:

i) Sequential numbering
ii) Metric numbering.
iii) Decametric numbering

i) ***Sequential numbering.*** This system subscribes to numbering existing properties in a continuous order. *For instance, 2, 4, 6, etc. – on the right side and 1, 3, 5, etc. on the left side.* It is important to note that, whereas it is easy to implement sequential numbering, this system can pose several challenges and cause confusion later if the properties are subdivided further or if several buildings are built on the same piece of property. In future, therefore, buildings that are constructed between existing plots/properties, or subdivisions done, after numbers have been assigned, will adopt the suffix of the assigned plot/property and use sub-numbers to the new development. For instance, subdivided Plot **365:** new plots: **365/1, 365/2, 365/3**…. and so on or **365/A, 365/B, 365/C** and so on (see figure 2).

ii) ***Metric numbering.*** Properties are numbered conforming to their distance from the start point of the street. Distance is literally measured and figures are rounded up or down to the closest even or odd figure depending on the side of the street. This system is simple, clear and easily understandable, since its ideology is based on distance from the start of a given street. The metric system has several improved qualities over the sequential system. They include:

- Very easy to be implemented in organic, informal and unplanned urban areas since it is based on a methodology of distance from known point of a given street.
- Immediate solution to challenges faced on addressing future cases of plot amalgamations and sub-division or new constructions/buildings (no need for suffix-split numbering such as 365/1, 365/2… 365/A, 365/B e.t.c)
- Distance from a known start of a given street makes locating of places much easier.

iii) ***Decametric numbering.*** Even and odd numbers are assigned sequentially as in the first two solutions, but according to **10-meter-**long sections of the street (as shown in table 2). This is a negotiation between the **sequential** and **metric** systems hence offering double advantage of simplicity and clarity in predictable distance numbering (Farvacque-Vitkovic, et al., 2005).

Table 2: Decametric Numbering System

Segment	Distance (m)	No. left side	No. right side
1	0 – 10	1	2
2	10 – 20	3	4
3	20 – 30	5	6
4	30 – 40	7	8
5	40 – 50	9	10
6	50 – 60	11	12
7	60 – 70	13	14
8	70 – 80	15	16
9	80 – 90	17	18
10	90 – 100	19	20
11	100 - 110	21	22

Source: Adopted from (Farvacque-Vitkovic et al, 2005)

2.5 Land and Property Rates

Globally, rates (also known as taxes) on land and property exist in all world Governments. These rates can have important financial and non-financial impacts. Sources of local revenue such land/property rates are the main source of funds for counties to perform their mandated functions. However, the extent to which Local Governments have control over revenues from land/ property rates is usually a vital factor of the extent to which they are able to make independent decisions on how to spend. Indeed, the level, design and control of property revenue system are thus critical elements in operational devolution process in many countries. From a more broad policy view, land and property taxes may be seen as either justifiable and effective ways of amassing local revenue or regressive and unattractive systems of generating public finance, depending upon one's assumptions, the environment and how exactly the rates are collected and used (Bird and Slack, 2004).

Following implementation of the Constitution, local revenue management is one of the devolved functions mandated to the County Governments. The responsibility of the County Governments on local revenue management requires authorities to ensure that the County performs its functions on provision of public services through the monies raised from different sources locally. Land/Property rates account for major sources of local revenue in most counties in Kenya. In 1990, property taxes first implemented in Kenya in Mombasa City, based on the yearly leasing value. In 1991, it was adopted in Nairobi City. As places evolved

throughout years and cultures, revenue system was implemented to the entire nation but the property taxes were mandated to the Local Government authority (Kelly, 2000).

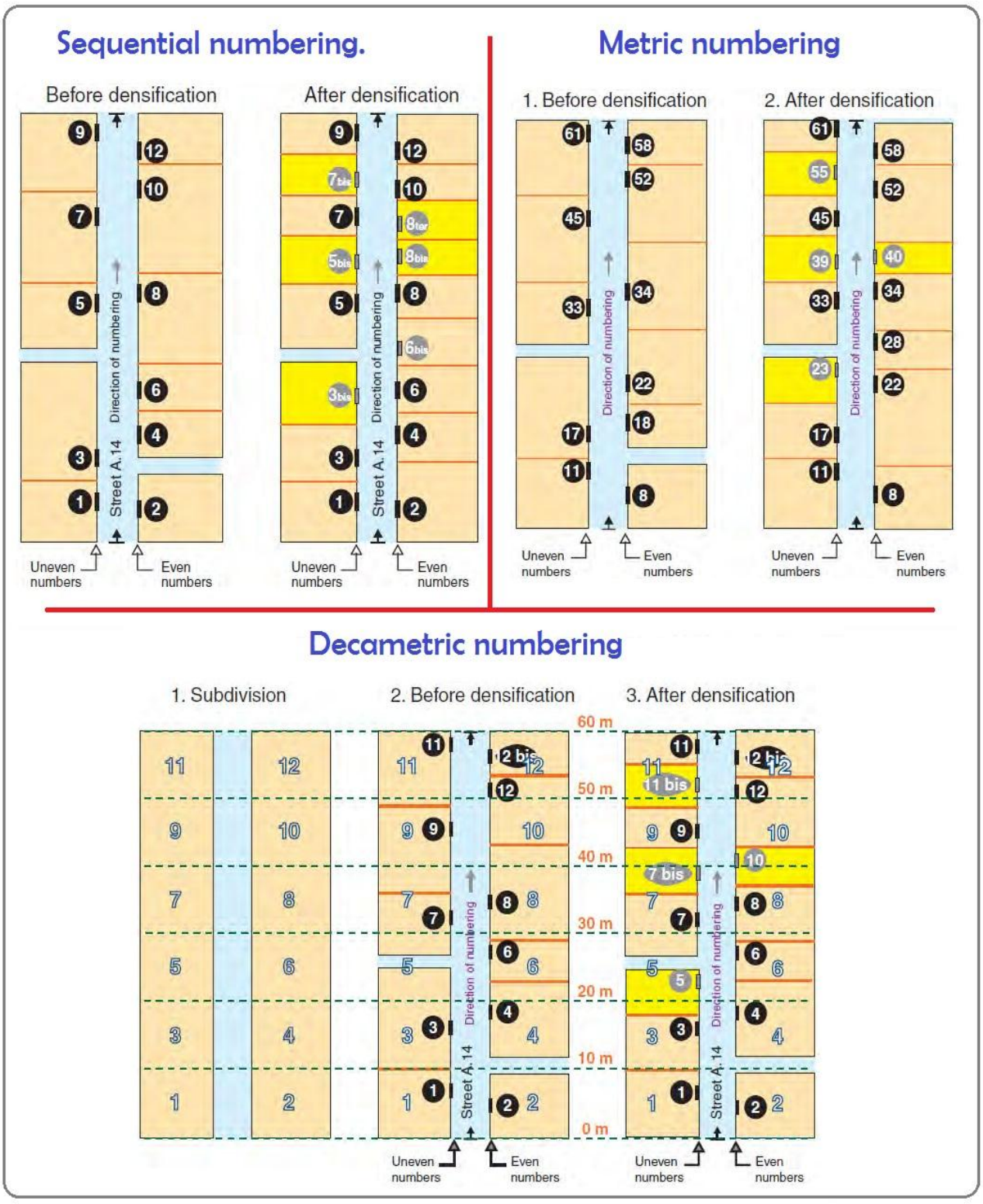


Figure 2: Numbering Systems for Street Addressing

Source: Adopted from (Farvacque-Vitkovic et al, 2005)

Revenue management, specifically of land taxes, has been a major challenge in most of the Counties. This is portrayed by the high rate of default which makes County Governments issue waivers to defaulters as a desperate means to lure them to comply with subsequent rate payments. It is as a result of, among other things, low level of collections by Machakos County and poor execution of their mandate that leaves a lot to be desired. This may, in turn, be caused by a lack of taxpayer understanding in the how the tax is imposed, collected and used. These problems arise despite the fact that the legal framework under the Rating Act gives Machakos County several options to ensure that unsettled balances are cleared. They depend on the clearance certificate, which has proved to be an incompetent practice. This is where the taxpayer is expected to clear outstanding debt when they want to transfer the property, or when a license or permit is required from the County Government.

The Kenya Rating Act 2012 (revised edition) mandates the local authorities to regulate the payable levies. The payable tax levies are set either by unit or value rate. The differential rates can either be relative or vary depending on land use, market land value, or land size. The County rating authorities are also mandated to choose a valuation rate of up to 4% without Central Government approval, beyond that the government through the relevant Ministry has to approve the proposed rate. It is done as a safety measure to safeguard the interest of the taxpayers. In Kenya, a uniform area rate or tax rate structure is generally used. The authorities with the higher tax rates tend to be those with the oldest valuation rolls. Machakos County uses differential rates based on land use such public purpose residential, commercial, and industrial among others. Properties in the CBD are rated using unimproved site value rating because it is a serviced area (GOK, 2012).

Kenya is a clear example of a developing country underutilizing its property tax capacity. According to records of survey conducted between 2000 and 2001, land rates/taxes accounted for an average of 22% of total recurring revenues for local authorities – this represented about 1.3% of total Kenya's tax revenue and 0.3% of country's gross domestic product. Outputs from an alternative study found out that property tax is the single most important source of revenue for local authorities in Kenya. This source of revenue has been said to be the most lucrative and promising. Property tax in Kenya, according to (Bird and Slack, 2002) is the least tapped source of tax.

2.6 Street Addressing System and Revenue Management

Among other objectives, one of the main merits of street addressing projects is usually contributions towards improved management of monetary resources. There two areas where street addressing can be applied in revenue systems:

a) Improving efficiency of the existing rating system
b) Reforming the land rating system.

2.6.1 Refining efficiency of the existing rating system

One of the primary benefits of using the address directory is the ability to obtain a list of economic activities that is usually more complete than the one used by the tax department and reveals the size of the population not listed on the tax rolls. The key challenge is the reconciliation of address data with tax department data. Using such a reconciliation approach, tax departments can evaluate the results of tax enrolment and tax collection efforts. At the same time, the documents and street identification make it easier to locate potential taxpayers. Usually, this is accomplished through the use of cadastral maps and subdivision plans that are often imprecise, and it requires the involvement of specialized staff. The main problem derives from the lack of spatial identification. The use of street addressing information with tax registers, therefore, constitutes an important step toward determining the tax base and increasing tax revenues.

2.6.2 Restructuring the Land Rating System

Normally land/property rates produce little revenue than anticipated for several reasons: there is no real political will to enforce it, central tax departments have little incentive to collect a tax that devolves to the municipal level, tax laws dating back to the colonial era are inadequate, and tax exemptions have been an overriding policy. Two factors create a gap between the objectives of a traditional property taxation system and the socioeconomic circumstances of the taxpayers. Firstly, it is difficult to use ownership as the basis for direct property taxation when titles are issued only sparingly and most people have no land title. This type of taxation system is poorly understood, and it is often difficult to distinguish between owner, renter, and occupant. And secondly, owing to the taxpayers' usual inability to pay and the objectively low value of the properties, tax levies have been limited to amounts that are often too low to make traditional property valuation and tax collection operation financially viable.

The management of a direct property taxation system is hampered by the complex procedure for assessing rental or commercial values when there is no formal real estate market, and

sometimes by the lack of administrative resources such as information systems and site visits. Such a system creates dysfunctions including unreliable tax assessments, frequent tax avoidance, a weak effective tax base, and perpetuation of procedural complexities from the assessment to the collection stage. In order to overcome these problems, municipalities have sought to simplify procedures and move away from reliance on a tax based on property valuation. Basing the property taxation system on occupancy rather than on ownership delinks the tax from the tenure status of the property, on the notion that every resident—whether he owns or rents his home—consumes urban services and therefore should help defray the related municipal costs. Rather than struggle under a cumbersome and complex taxation system based on antiquated, largely unenforceable tax laws, municipalities are moving toward simplification of the tax laws and adopting a property taxation approach more closely aligned with existing capacities and resources (Bird and Slack, 2002).

2.7 Geographic Information System (GIS)

Once established to assist in management of natural resources and environmental conservation, GIS (Geographic Information System) technology has advanced to a tool that finds use in most fields of human undertaking at local, regional and global levels such as street addressing, locating places, land use planning, suitability analysis, management of urban utilities, disaster management, monitoring and evaluation among other fields. GIS is a powerful tool used for computerized that has replaced most of cartographical works such as mapping and spatial analysis. A system provides spatial data entry, management, and retrieval, analysis, and visualization functions. The potential for applying GIS technologies and other related technologies is growing by the day. GIS applications have quickly grown from mere map-making to providing real world solutions for the numerous and very often complex problems facing our communities on day-to-day basis. This ideally means that GIS is no longer a monopoly of scientists (cartographers, surveyors and ecologists), but is now increasingly being applied in other industries such as health, crime, marketing, real estate, aviation, insurance among others.

GIS applications focused heavily on the traditional areas of its applications such as land use/land cover mapping, census mapping, urban mapping, environmental planning and management, disaster/hazard risk management, among numerous others. Even within these traditional areas of GIS application, the emphasis remained on macro level mapping where interest was on mapping expansive entities such as natural resources, urban areas, and population. However, with the rapid evolution of digital technology, and more specifically,

GIS, the horizon of GIS applications has tremendously broadened. GIS now utilizes sophisticated database systems, allows easy overlay of data in different projection systems, fully integrates raster data and allows internet mapping. GIS is therefore not only becoming more powerful but more relevant (Khamala and Karimi, 2004).

2.7.1 Historical Evolution of GIS

Before 1960 – Paper Map Predominance (Before computers): All mapping work was done manually on paper. Globally, the computer mapping technology was not developed. Maps were mainly used for way finding and locating of new/unfamiliar places. After 1960 to 1980's, computers were invented and initial steps of GIS Development were made: Early rapid urbanization trends were being experienced. Most technological milestones were made during this period as countries embarked on development agendas. It is in this period that the discovery of second generation of computers (with programming languages, storage memory and operating system) totally changed the face of mapping and development of GIS technology. GIS development credits are given to Roger Tomlinson, collaboration with Canadian Government, initiated, planned and directed the development of the Canadian Geographic System (CGIS) in late 1960's. This was a historical milestone in GIS development since CGIS is considered as the foundation of GIS development. CGIS implemented a layer approach system to mapping (www.gisgeography.com, 2017).

1975 to 1990 – Making money from GIS: As major enhancements in computer technologies were being made, planning authorities started to realize the merits of digital cartographic works. Then, improvement on storage, performance and graphics of computers had a direct impact on quality and efficiency improvement on the mapping world. New cartography products started creeping in the market. This attracted interest in number GIS product vendors in the market around late 1980's. ESRI, a giant GIS software developer was launched with other GIS consortiums starting to come up also. ARC/INFO was first introduced and tested in 1982.

1990 to 2010 – GIS user at the center stage: This period is credited as when GIS made major strides. Application of GIS was being introduced in different fields such as education, entrepreneurship, research, in an endeavor to create visual map analysis. By this time, computers were much advanced, variety of GIS software options, spatial data availability and advancement of remote sensing technology, streamlined the penetration of GIS to the people. (www.gisgeography.com, 2017).

2010 to Present – The Era of Open Source, Big Spatial Data and Cloud GIS: The invention of open source technology for GIS in this era makes access and sharing of spatial data possible. With improvement of GIS technology and expansion of geo-spatial industry to other fields, there is so much spatial data generated on daily basis. These spatial datasets accumulate to a point that handled and managed efficiently by common database management systems therefore categorised as big spatial data. Overtime, the demand for storage and effective handling of big spatial data increased resulted to development.

2.7.2 Relationship of GIS and Street addressing system

A theoretical statement by International Federation of Surveyors (FIG, 2001) claims that nearly 80% of all information generated is based on particular geo-spatial components. Geospatial information is used to making critical decision-making. An integrated approach of merging GIS technology and descriptive addressing system has a vast range of benefits. First, it adds efficiency in way-finding and mapping exercise for the codification of streets and numbering of properties. The created GIS database is useful to a number of users such as the public, business proprietors, city planners among other users. For town and urban planners, a GIS-based street addressing system will make it easy for them to track and maintain public facilities; keep inventories, map location, model scenarios and distribution of services. From time to time, the database can be easily updated to keep it in line with the current trends.

GIS technology incorporates common database processes such as querying and statistical analysis with the distinctive visualization and spatial analysis benefits displayed by maps. These capabilities distinguish GIS from other information systems making it appreciated to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies.

2.8 Evaluation Factors for GIS-based Street addressing system

An ideal Street addressing system for management of revenue should at least fulfil the following basic requirements:

i. Simplicity and clarity: should be developed on a concept that is clear and easily understandable by public.

ii. Employ a predictable numbering system that will enable user to envisage places at first instance allowing time saving and accurate locating of places.

iii. Improve communication and decision-making.

iv. Expandable and updatable: Street addressing must have the capacity to grow the process to neighbouring zones stretch to cover even the entire country in a clear and understandable procedure. The developed geo-database should be updatable to spatial changes on land and land use.

CHAPTER 3: MATERIALS AND METHODS

3.1 Area of Study

The study covers an area of about 0.6 km^2 of Machakos town within the CBD (Central Business District) zone. Machakos town is located approximately 64 km Southeast of Nairobi City. It is the administrative headquarters of Machakos County. The County boundaries confined within latitudes 0º 45' South to 1º 31' South and longitudes 36° 45' East to 37° 45' East. The county has an altitude of 1000 - 1600 meters above sea level. The geographic location of study area been displayed on figure 4.

3.2 Methodology

In this section an assemblage of the specific systematic steps undertaken in the study to develop a GIS-based street addressing system and a geo-database for management of land rates within Machakos town CBD are discussed. Generally, this study based on two (2) broad modelling processes: Physical Modelling and GIS modelling as shown in the diagram below:

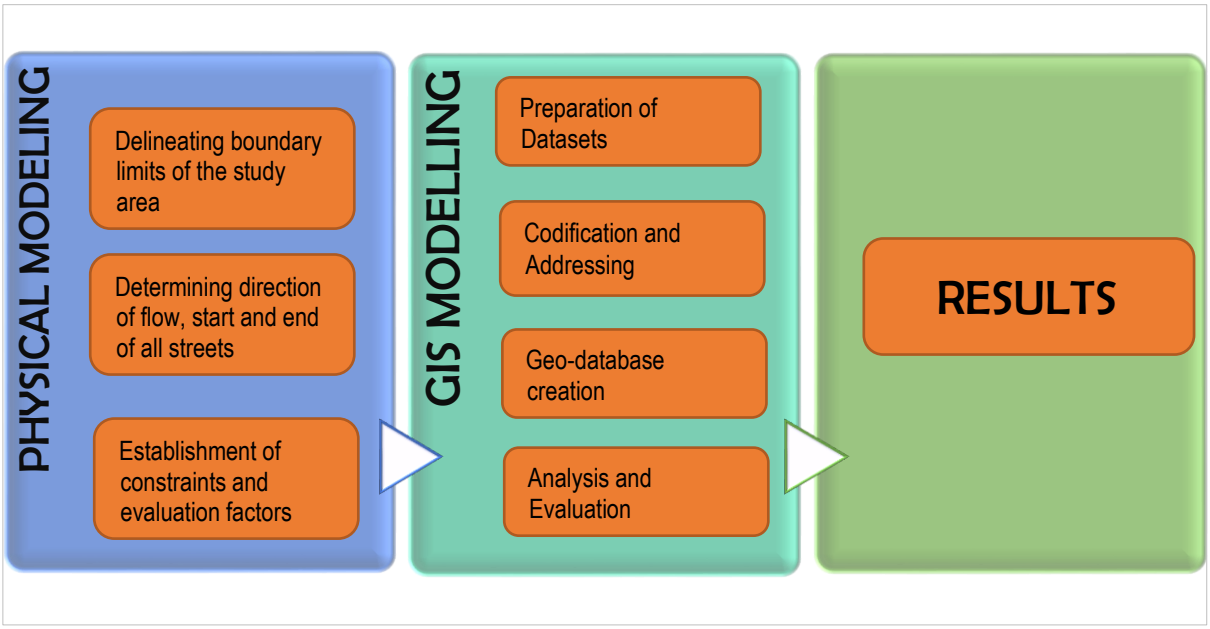


Figure 3: General methodology Overview

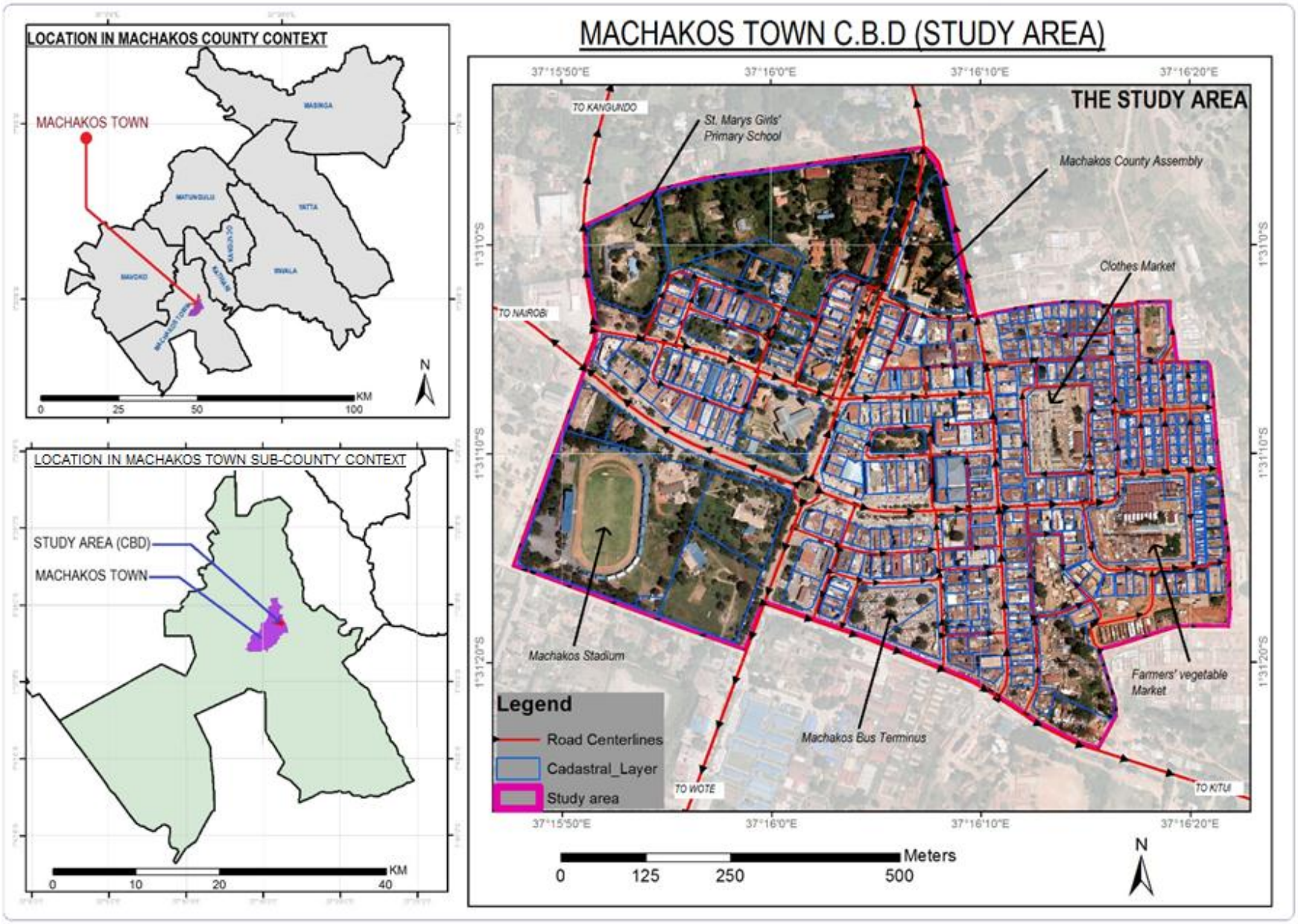


Figure 4: Geographic location Map of Machakos Town CBD (study area)

The physical modelling can be summarized as part of preparatory segment (by extension) that was executed prior to ensure smooth flow of the entire project. On the other hand, the GIS modelling methodology was organized in to 4 phases (*shown in the Figure 5: Comprehensive GIS Modelling Methodology*") namely:

- Phase 1: Preparation of Datasets
- Phase 2: Codification
- Phase 3: Geo-Database Creation
- Phase 4: Analysis of the Results

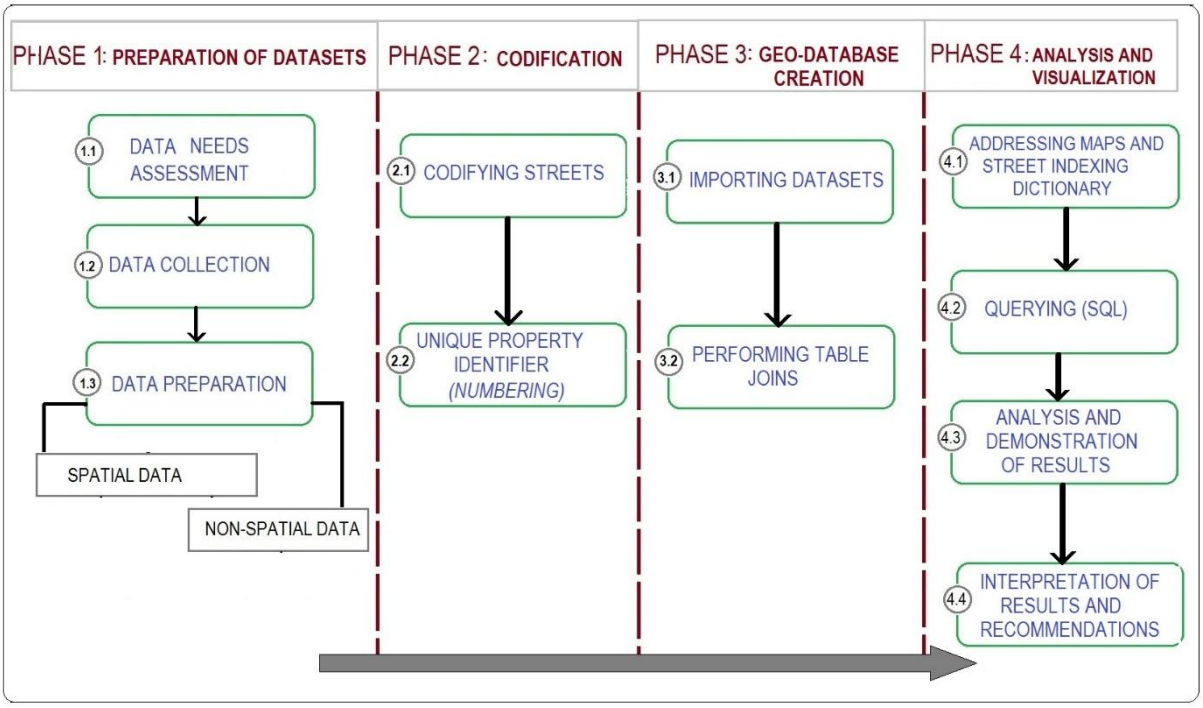


Figure 5: Comprehensive GIS Modelling Methodology

3.2.1: Preparation of Datasets

Preparation of the datasets is the groundwork that determined the results of a project. First, the aforementioned physical modelling was implemented to establish how to execute the GIS modelling processes before much time and resources are invested for the study with vain results. Therefore, preparation of datasets involved:

a) An assessment of data required for the study,
b) Essential GIS hardware components for the study,
c) Software programs,
d) Data Preparation (Data Editing and Cleaning).

A) Data needs Assessment: Data Required

This involved gathering and collection of both spatial and non-spatial data from actual fieldwork and secondary sources of data. The table below illustrates type of data used in the study, format and where the data was sourced.

Table 3: Data Sources

Data Type	***Characteristic/Format***	***Source***
Study area Aerial Image	ECW file format, 10m by10m Resolution, Area 1.5 Km^2	Regional Center For Mapping Resource For Development
Administrative Boundaries	Shapefiles	Kenya Independent Electoral and Boundary Commission (IEBC) Data
Cadastre Layers	RIM Sheets of study area	Survey of Kenya
Road network map	Hard copy sheets/ Shapefiles	Kenya Roads Board/ Open source data
Annual Revenue Statistics	Excel sheets (Soft/Hard)	Machakos County Planning office
Parcel land use attributes plot Inventory within the study area	Attribute Texts	Open source data

B) Essential Hardware Components

The table below shows the hardware components to be employed in the study, their specific usage and feature components.

Table 4: Hardware Components for the study

Hardware	***Usage***	***Features***
PC Computer:	Workspace where all mapping, graphic design, presentation and report writing were executed place	CORE i5 vPro, 4 GB of RAM, 5.2 GHz speed and 750 Gb Hard disk
Flash disk:	To transfer files from/to PC	8 GB
HP Printer and Scanner:	Scan map sheets for digitization Print report and exported maps	LaserJet
Hand Held GPS	To collect point data of main facilities and land uses	GARMIN, Dakota 20, powered by 2 AA replicable dry cells.

C) Software Programs:

The table below elucidates the software programs the study employed execute the specific tasks in this research project – Their specific use has also been detailed out below.

Table 5: Software components for the study

Software	***Use/ Importance***
ArcGIS Version 10.4	Geo-referencing, digitization spatial adjustment Data manipulation, querying, analysis and visualization.
Global Mapper 12.0	Coordinate Transformation of the RIM sheets
Adobe Photoshop and Microsoft Paint Software	Customization and basic graphics for the report
MS Word Office (2010)	Report writing
MS PowerPoint.	Presentation of the main highlights of the project

D) Data Preparation (Data Editing and Cleaning):

Once data was collected, it then underwent manipulation processes, sorting and prepare it for the development of an addressing system geodatabase precisely dedicated to achieving the objectives of the study.

Table 6: Data preparation procedures

Editing Method	***Preparation Procedures***
Scanning and Geo-referencing	RIM (Registry Index Maps) blue print sheets were first scanned then geo-referenced
Digitizing	Scanned RIM cadastral sheets were be digitized and plot number attributes populated on the shapefile generated. Road Centrelines were digitized using the acquired aerial image, while open source data will be used to populate the attributes.
Spatial Adjustments and Topology analysis	These are checks executed to clean further errors and improve on geo-spatial data accuracy and ensure the cadastre information required would snap (jigsaw-fit) with existing ground information (as per the ortho-rectified aerial image).

Working base map for developing a street addressing system

The overall objective of all processes involved in preparation of datasets phase was to build a base map to develop street addressing system for management of land taxes within the study area. The prerequisite layers for developing base map for developing of a street addressing system include: cadastral layer and road centrelines as shown in figure 6**.**

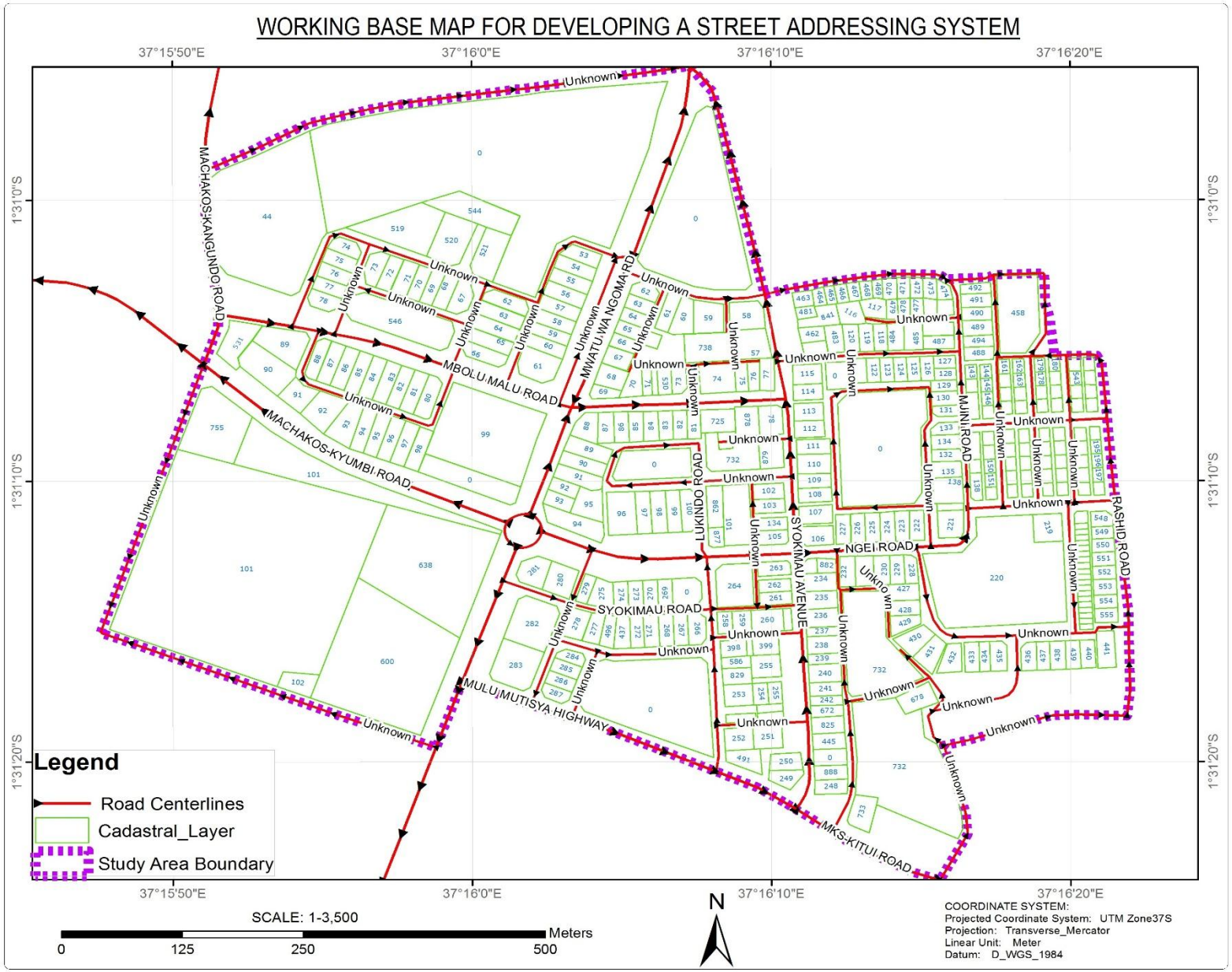


Figure 6: Working base map for developing a street addressing system

3.2.2: Codification and Addressing

After all the road centrelines and plots were digitized and data cleaning executed, the subsequent process involved codification and addressing. This phase entailed systematically numbering and naming of streets and assigning unique codes for identifying plots/parcels/properties within the study area. Codification forms the backbone of the address database. In addition, the coordinate points of start and end points of each street were generated together with the address point centroids (coordinates) of each parcel/property. The following steps were followed in this phase:

a) Establishment of point of reference

Once all street centrelines were digitized, a point of reference was to be developed so as to flip streets to the correct direction orientation. Point of reference or "point zero" was develop as a point where all roads refer when starting numbering which increases gradually from the aforementioned point. Start and end point of every street must also be defined with correct orientation from point zero.

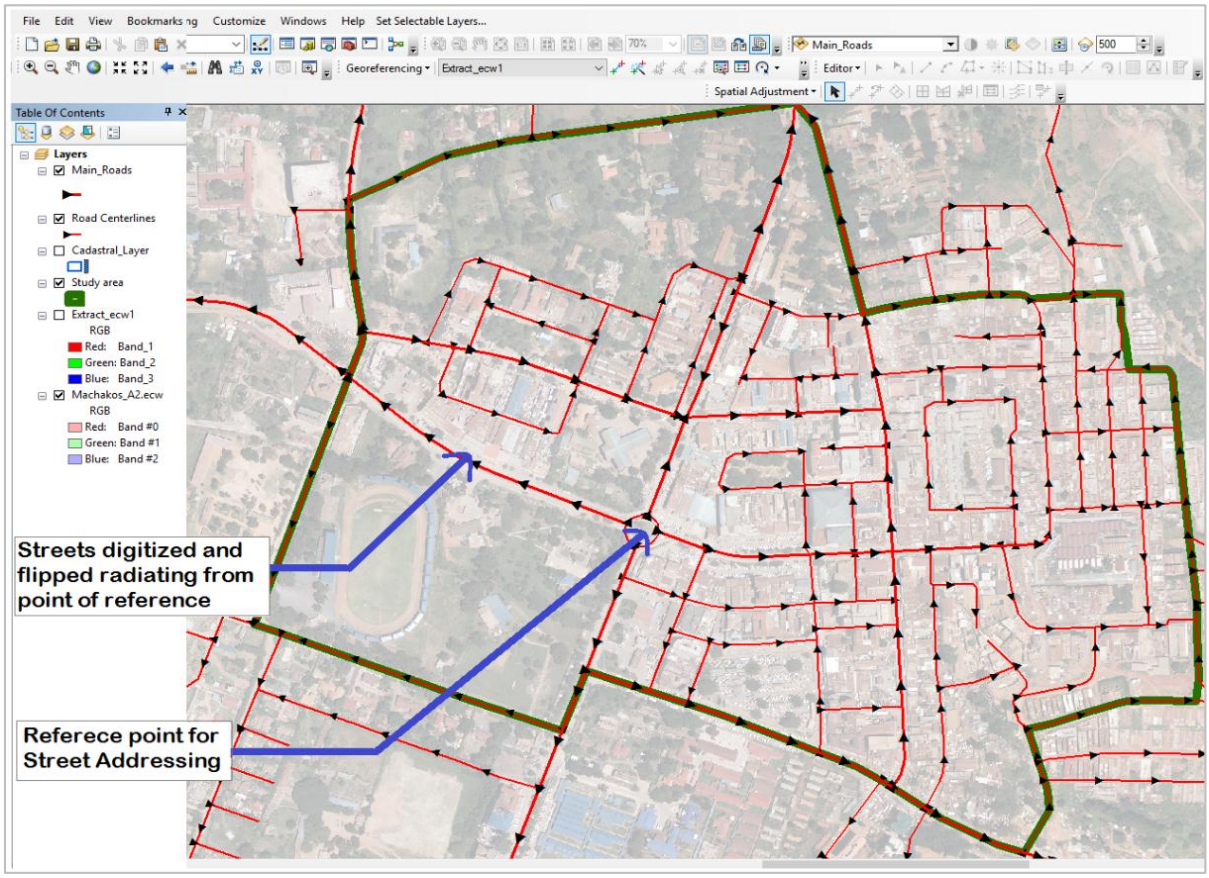


Figure 7: Reference Point and Digitizing streets

b) Development of addressing localities

Despite the study area being a section of the CBD area, a conceptual demonstration on how to expand addressing to the rest of the town was deemed necessary, as it is the first stride in the beginning of creation of addresses. Addressing localities or what is termed, as "zones for addressing purpose" are important since they provide complement on simplicity of the process. For instance, road 2 can be in all/different zones, therefore, the practice is that the roads to pick abbreviation (as a prefix) of the developed localities to eliminate confusion (for instance, CBD road 2, ABC road 2, UVW road 2, YYY road 2 and so on).

The best system adaptable in the study area for development of addressing localities for expansion of addressing system to other zones is anti-clockwise spiral system of numbering with the study area as the start point.

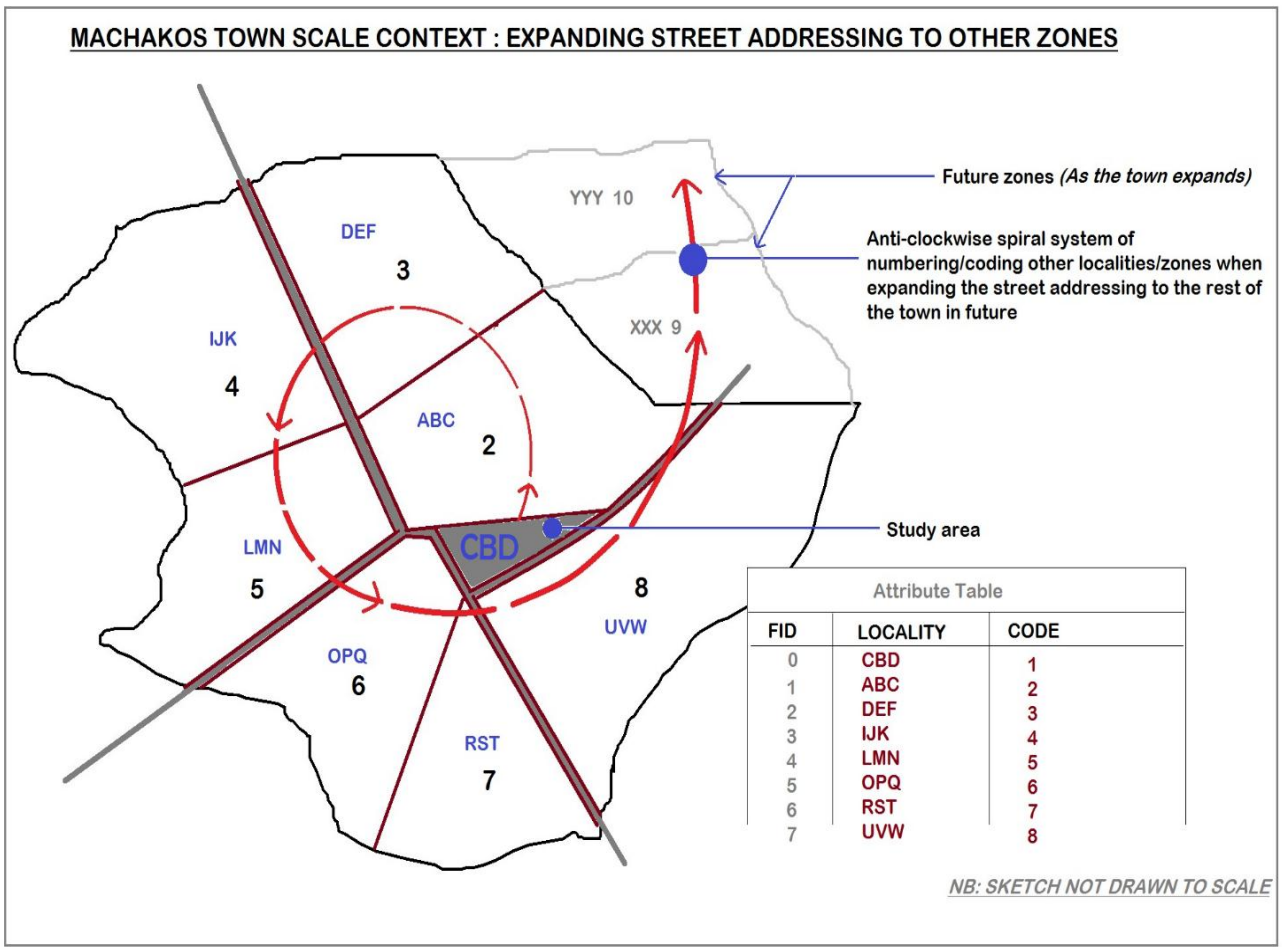


Figure 8: Conceptual design of developing addressing localities

c) Street Coding

Once the street were digitized, oriented accordingly in locus to the reference point (point zero), start and end point of each street determined; the next step involved sorting roads on orientation basis, that is, 2 categories comprising all roads oriented from North to South and those oriented from West to East. This therefore meant that, all roads running form North-South (N-S) were coded with **Odd numbers** while those assuming the West-East orientation were codded with **Even numbers,** as shown in figure 9 below.

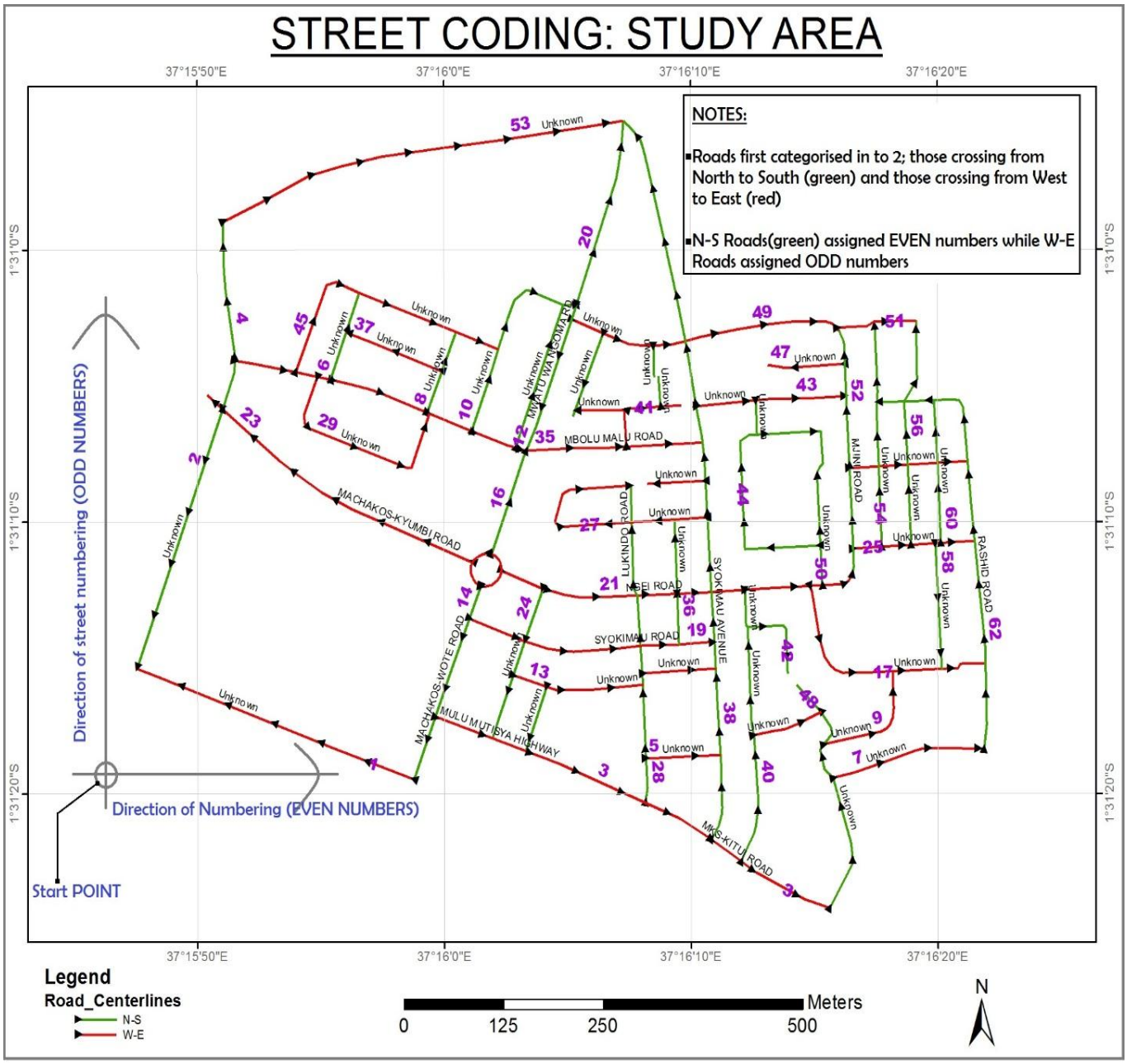


Figure 9: Map on Street Coding in the Study Area

d) Addressing Plots

The study embarked on **sequential system** of addressing within Machakos CBD because of the grid layout organization of plots and streets. As earlier explained this system subscribes to numbering existing properties in a continuous order *for instance, 2, 4, 6, etc. – on the right side and 1, 3, 5, etc. on the left side.* Sequential system is ideal because it's easy to implement on a grid system where planning development control measures limit further subdivision or amalgamation of plots like the case of Machakos C.B.D. However, in the immediate zones of the study area, due to the organic growth nature of the town, the Metric-system of property numbering is most suitable due to its ability to adapt to changes in parcel sizes i.e. future expected land/plot amalgamations and subdivisions. With reference to point zero and direction of the streets, property/plots on the left side of the street were addressed with **odd numbers** while those on right side were addressed with **even numbers**. Corner plots (those located at cross-sections), the plots were assigned addresses in preference to the road of higher hierarchy e.g. a highway was given priority over an access road. However, in some cases a plot could fall at cross-roads of same hierarchy, therefore, in that situation, the road closer to point zero (reference point) was given priority. See figure 11.

3.2.3: Building Geo-Database

A geodatabase is a collection of geographic datasets of various types (ESRI, 2006). It is the most primary mechanism used to organize and use geographic information in GIS-based software programmes such as ArcGIS. A geodatabase contains three primary dataset types: Tables, feature classes and raster datasets.

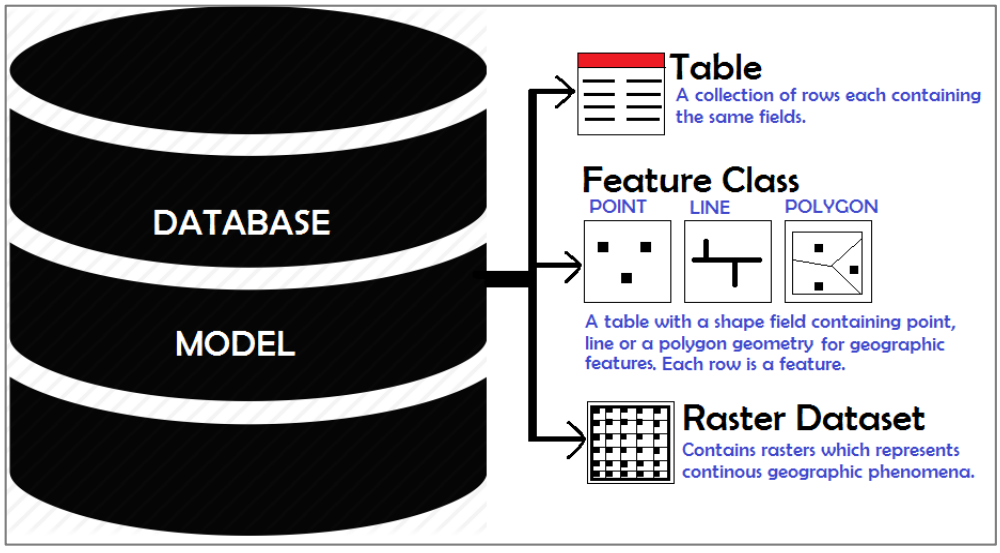


Figure 10: General Conceptual database design model

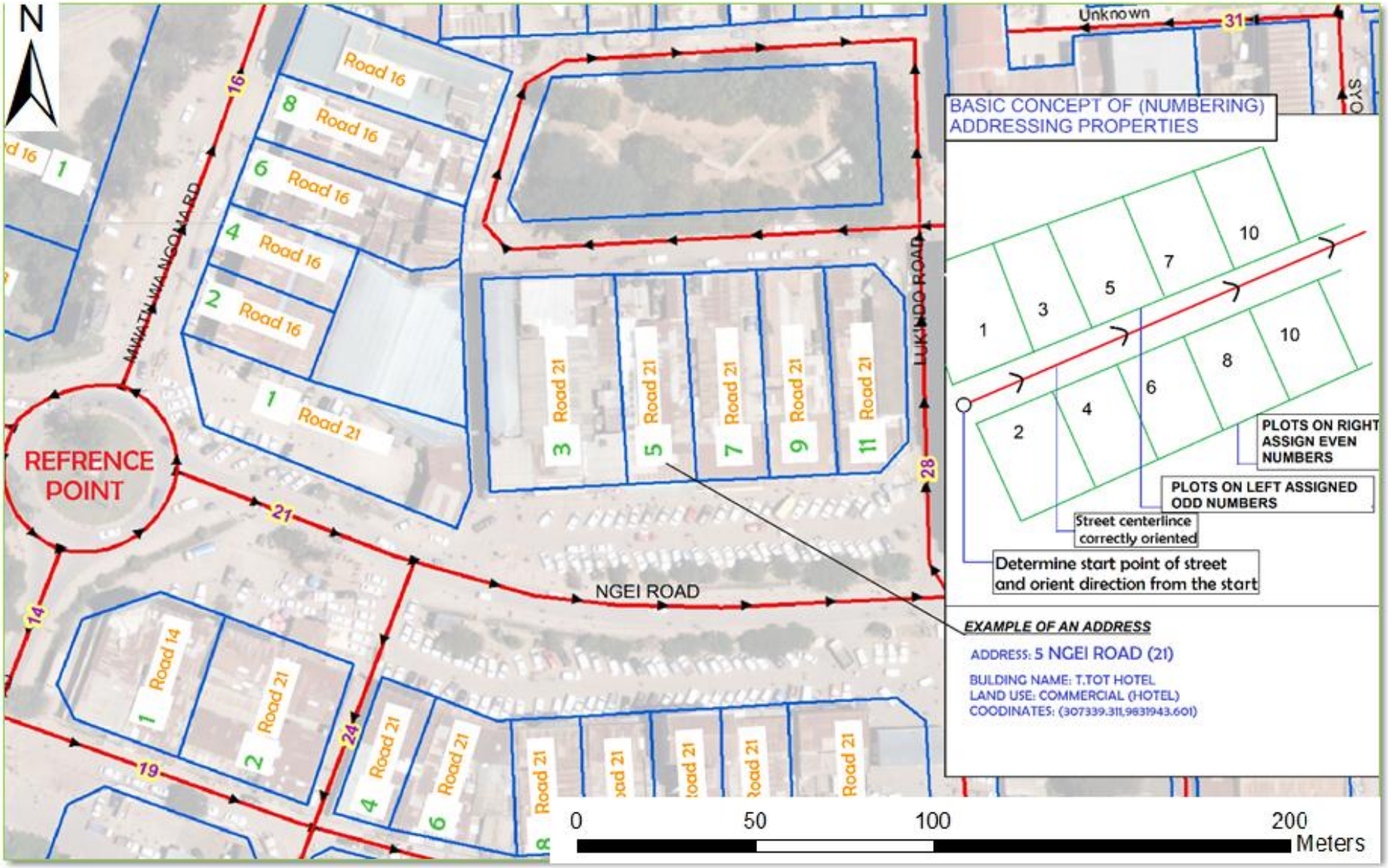


Figure 11: Conceptual idea in addressing plots

Building and design a GIS geo-database of address index and land rates inventory entailed importing datasets from road/streets and cadastre layers then perform table joins. For the purpose of this study, feature classes and tables were used. The raster dataset was used purely for representation. A new folder was created in which the *personal geodatabase* was designed and named in the ArcGIS ArcCatalog environment. On the ArcCatalog environment, a new folder was created where the "new personal geodatabase" was generated and re-named as shown in the figure below.

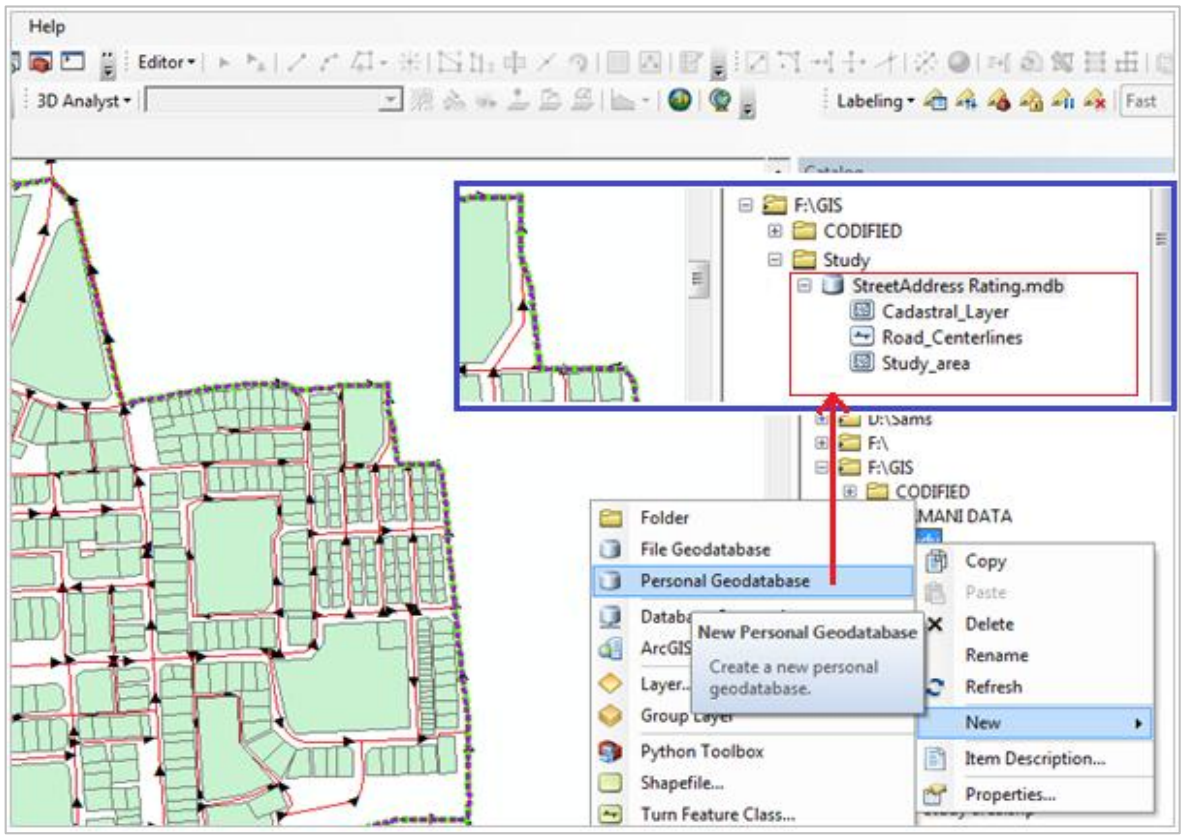


Figure 12: Creating Personal Geodatabase

Designing Relational Tables

However due to the nature of data which requires interoperability, a relational database model is ideal. This can be designed in the ArcGIS environment by joining tables in the geodatabase. As earlier illustrated, information in a geodatabase is stored in tables, feature classes and raster datasets. Tables carry the attribute information where each table contain specific themes (allowing easy manipulation of information) instead of one huge table with all the information. Linking the different tables can be done when one needs information that is not in the table currently being used. If the information is stored in compatible format tables, it can be associated with the features in the personal geodatabase for display.

Relating tables one is able to know the details of the plot/parcel of interest such as: the geographic location, centroid coordinates of the plot, the owner, parcel LR. Number, land use, their postal addresses and telephone numbers. area of their parcels, the land use of the parcels, name of the buildings, the number of floors (which is essential when collecting the single permit charges) and the land rate status (meaning, if he/she is a defaulter or not a defaulter). For the purpose of this study, relationships were built by relating cadastral information to streets (each plot/parcel linked to the street that is used to access the plot in question), as shown in figure 13.

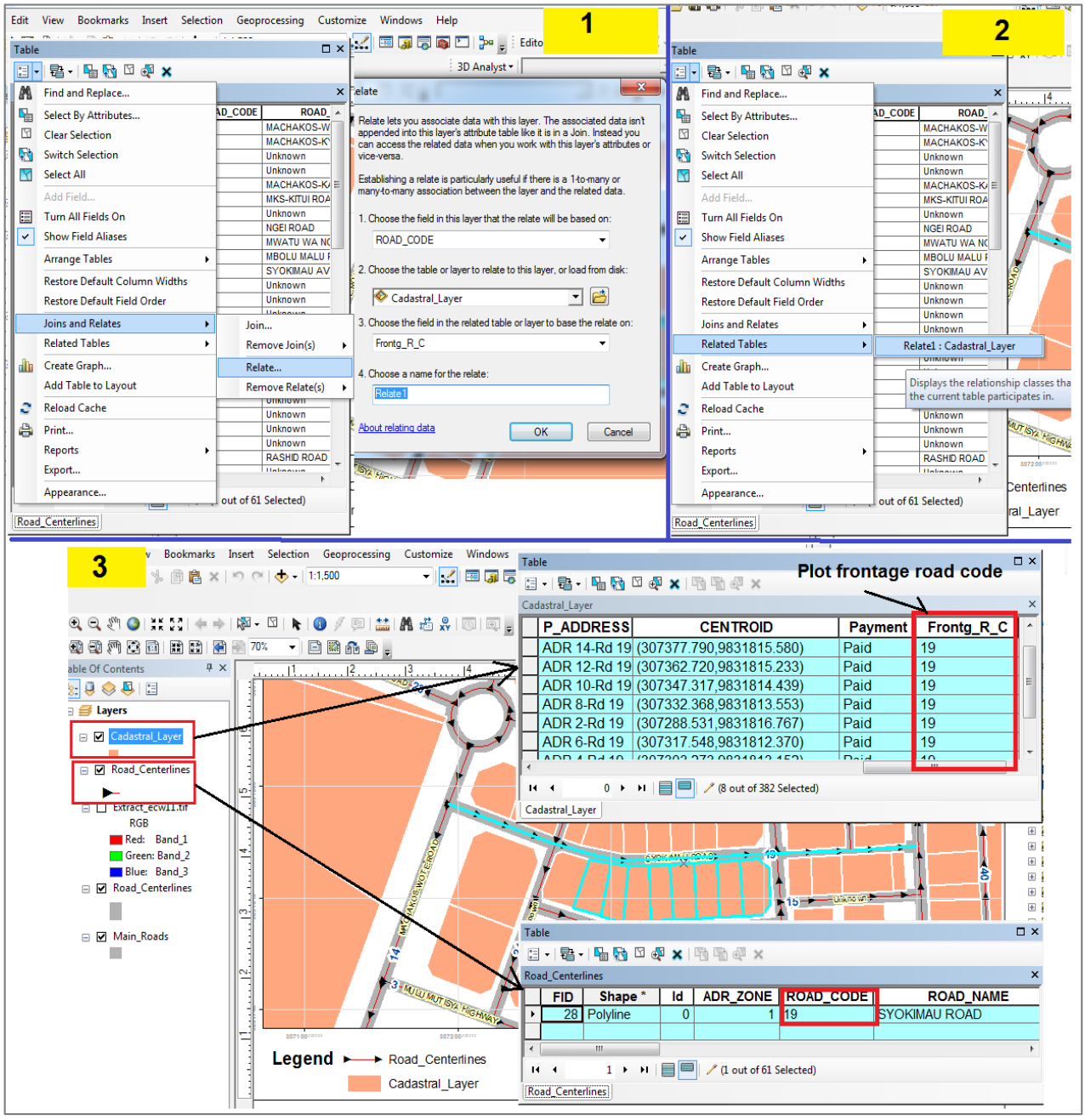


Figure 13: Designing relational tables

CHAPTER 4: RESULTS AND DISCUSSIONS

This chapter presents an assemblage of results and discussions of the study findings. The findings and results are based on the research objectives. To demonstrate the potentials of a GIS-based street addressing system in the management of land rates in Machakos CBD, the results have been displayed in form of queries, tables and maps for:

a) Land rateability status
b) Street addressing and land use inventory
c) Land rates payment inventory
d) Street address index register

4.1 Existing Rating Situation in Machakos Town.

To date, besides the aforementioned percentage of the national budget share among 47 counties, Machakos County rating department also collects revenue from local revenue to fund basic public service provision and maintenance of local infrastructure. The main local sources of revenue Machakos County include

a) Land/property rates
b) Levies
c) Rents
d) Fines
e) Forfeitures/penalties
f) Taxes (direct and indirect)
g) Business permits and licences
h) Parking fees
i) Cess fees

Rates in Machakos County are only collected to rateable plots/ properties as provided by rating law. Management of rates and collection are two separate entities where rates collecting officers only deal with collection while the rates managing officials are mandated in the management, supervision and decision making on revenue generated.

Current Rating System used in Machakos Town

In 2014-2015 Machakos County introduced an automated rating receipt system for revenue collection. However, the manual receipt system was not completely phased-out. Up to date

both systems are still being used. The automated rating system is receipt-based (only meant for issuance of receipt to customers). The tax collection records are recorded in books and Excel spread sheets for maintenance and accountability. Therefore, this means that the current system does not have the geospatial component and geo-tagging of the ratepayers making it difficult for revenue managers to track tax defaulters. The current tax management system also lacks ability to perform spatial analysis and visualization component that a GIS platform could perform and demonstrate (Mutisya, 2014).

4.2 Land Rateability Status

Rateability is the state of being legally responsible to valuation and or taxation. Drawing form the Rating Act (Cap. 267), rates are payable to the local authority jurisdiction in which the property is located. However there are institutions which are by law relieved from payment of rates, these include: cemeteries, hospitals, public religious worship places, museums and national parks, etc. These institutions are specified in the Rating Act and are gazetted and approved. From the study, a sizeable sample of land parcels within the study area is not ratable because the land is owned by Government institutions, County Government or with County public infrustructure that generate othor (GOK, 2012) . Some of the unrateable facilities and properties within the study area include:

a) Markets (*Wakulima* and *Mitumba* markets)
b) Machakos Police Station
c) Religious institutions
d) Schools
e) Bus terminus
f) Machakos Kenyatta Stadium
g) Machakos County Assembly
h) Environmental Conservation areas
i) Unsurveyed plots

The map displayed as figure 14 shows the rateablity state/status of all the plots within the study area.

.

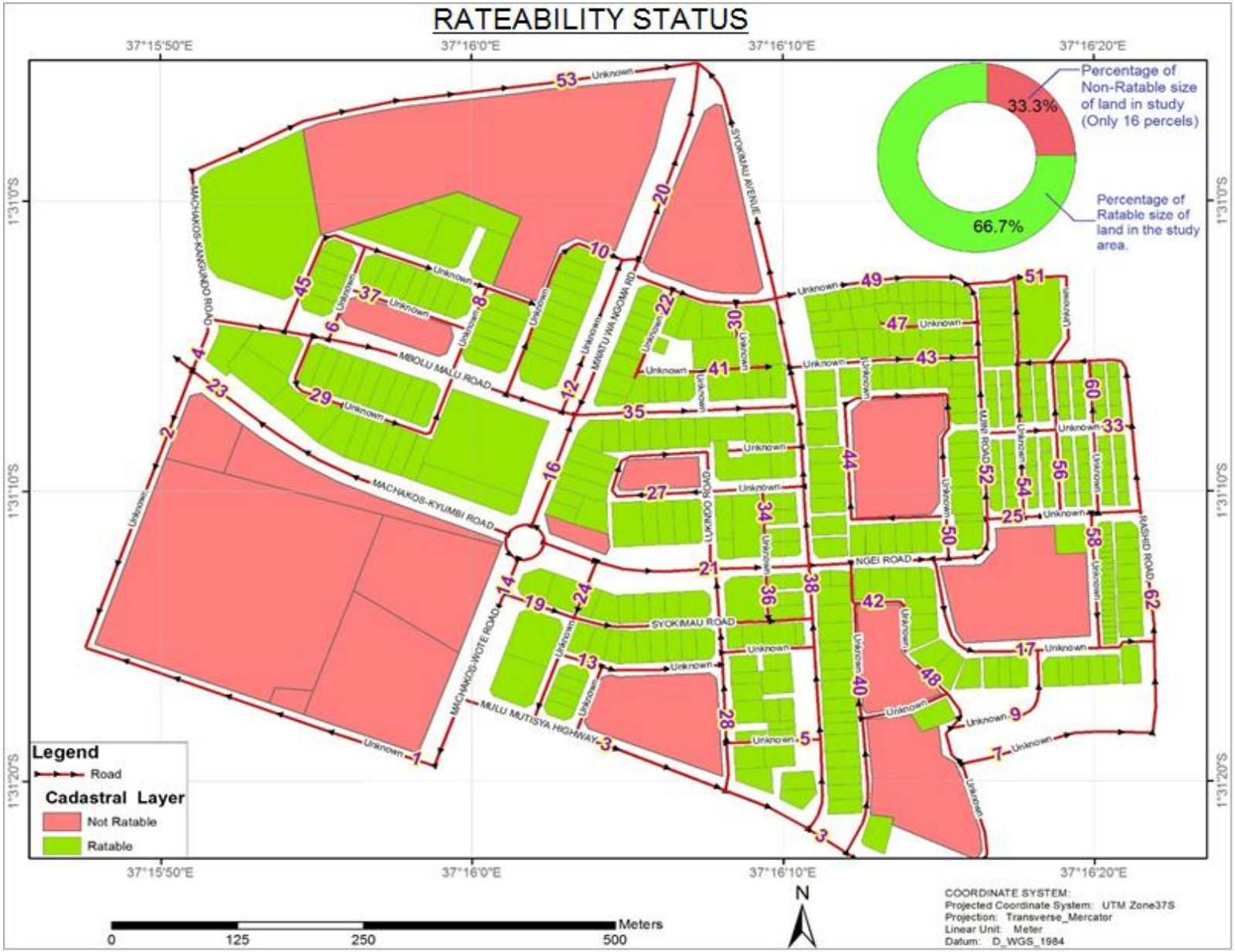


Figure 14: Map on Ratebility Status of the plots in the Study area

Using street address makes it easy to perform ratability inventory. It makes it easier to locate rateable/non-ratable plots. For instance, when performing a simple query to higlight plots which are not rateable, its easy to get street address attributes of the plots in questions. Taking a case of a single plot in figure 15, plot of address(ADR)2 along road 16 (address is important since the road does not have a name) its not rateable. This make it much easier to spatially locate the plot using an address and a street. Further querry on the land use attribute will reveal reason: for this case it's a church, a religious institution which is exepted by the Rating Act of Kenya (Cap. 267) from taxation.

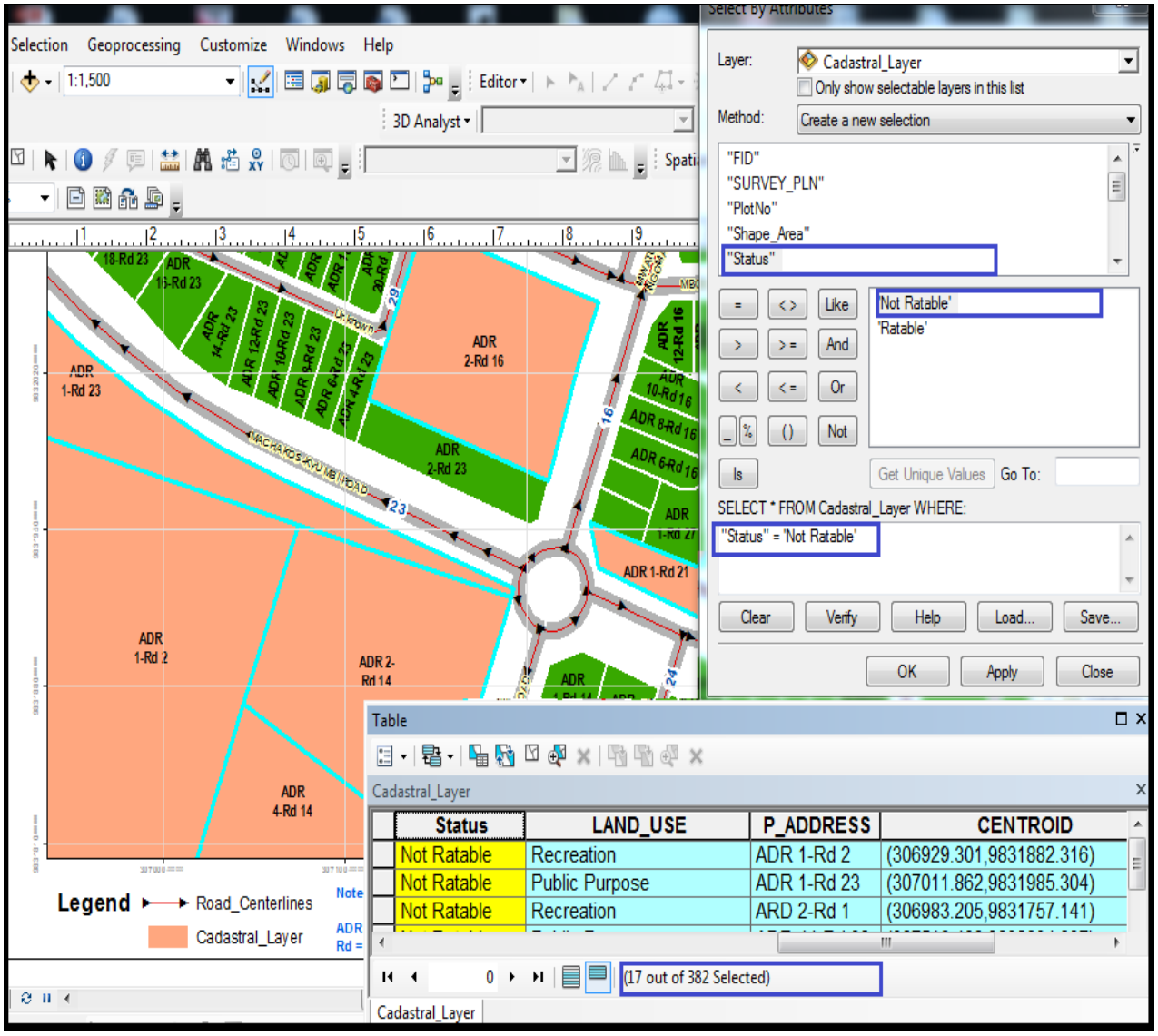


Figure 15: Street Addressing and Rateability status query

4.3 Street Addressing and Land use inventory

Different land uses attract different property values which are factored in the rates payable. With street addressing geo-database, its easy to populate land use attributes, querry and develop a land use map. Landuse is an important component especially at the CDB area. Rating/Revenue management in Machakos is able to do a land inventory and monitor payment of rates from different land uses (since different land uses attract different rates). In addition, with street addressing, a rating management official is able to do a precise location of parcels (with their existing land use category) which can generate high rates and those that do not genarate rates at all as illustrated in the figure below. For instance, a query to locate all commercial land use plots within the study area (total of 166 out of 382 plots), then promt query for the other land uses and apply simbology to generate a land use map for the various land use categories. With all plots having addresses, it becomes possible to link specific address, plot and its land use.

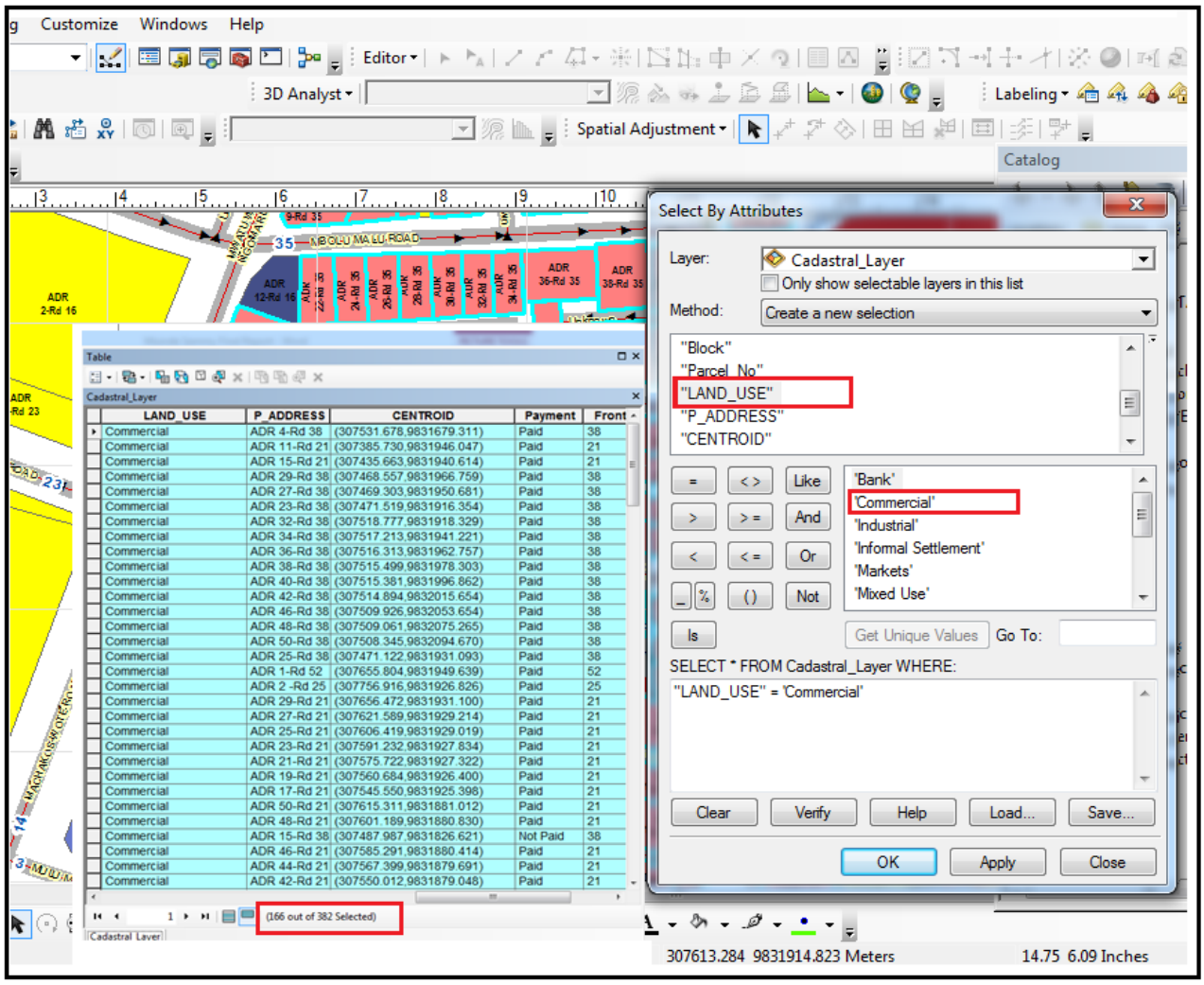


Figure 16: Sample query of street addressing and land use inventory.

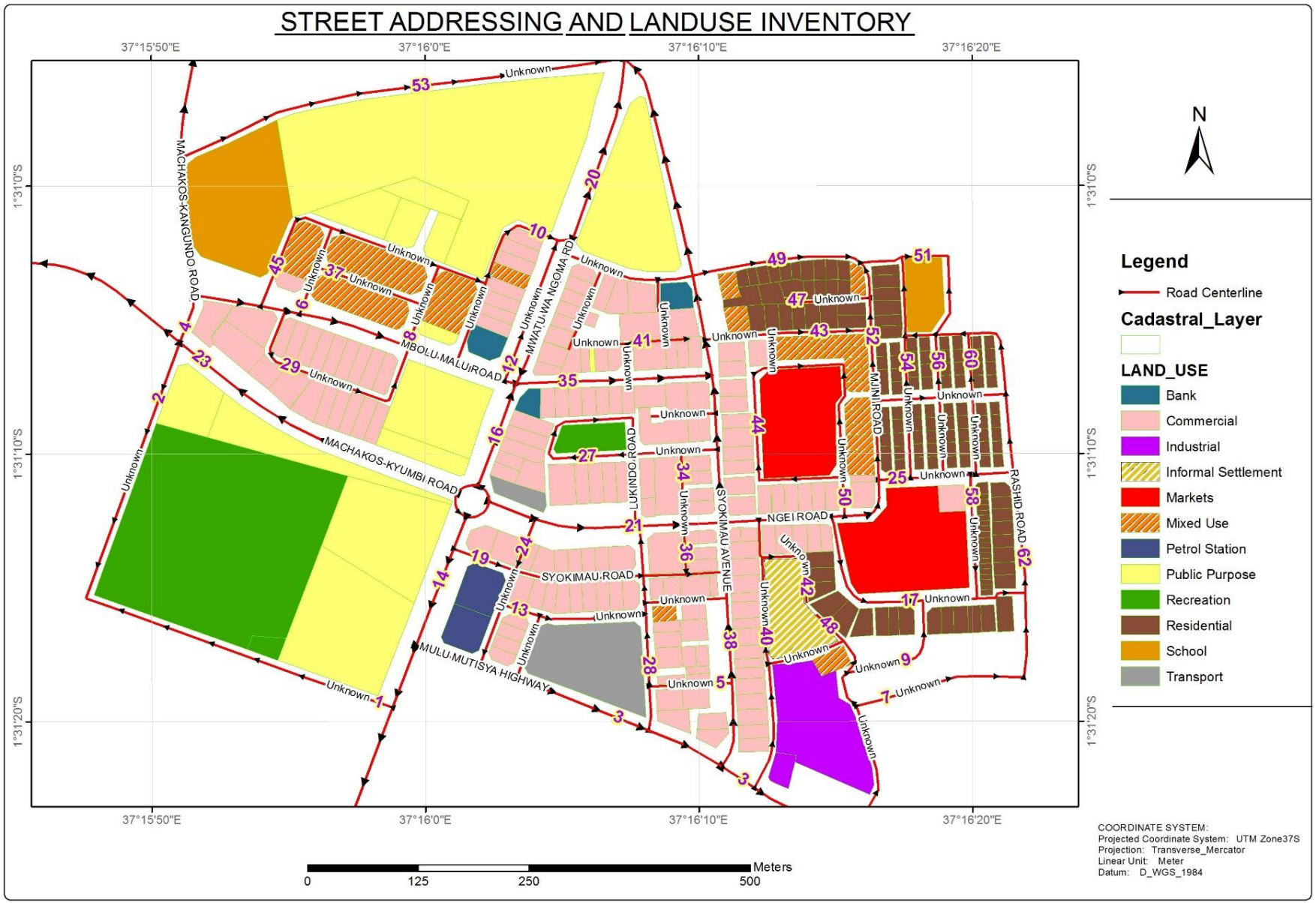


Figure 17: Map on Street Addressing and land-use inventory for the study area

4.4 Land Rates Payment inventory

One of the main objectives of the study was "to do a comprehensive land rates inventory register using a GIS-based street addressing in the study area". This was achieved by populating the payment status (either paid or not paid as at 2017) attributes of each plot within study area. A simple query in the ArcGIS platform was able to select all plots that have not paid rates in the study area, while at the same time know the exact number/count. For this case, a sizeable sample (about 19%) 71 out of 382 plots in the study area have not paid their rates.

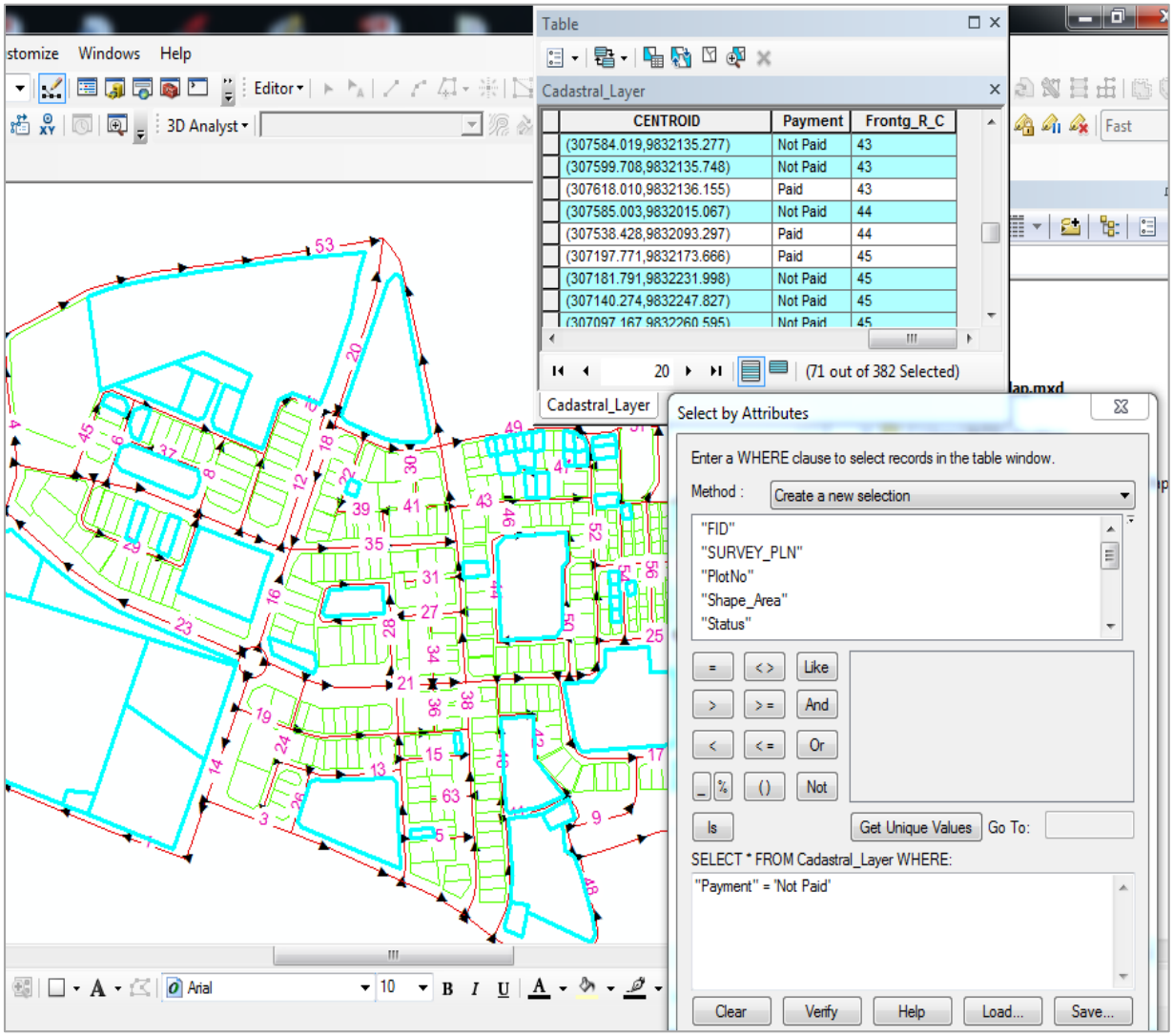


Figure 18: Land rates payment query

In Machakos County, collection of rates and management are done by two units. This arrangement where collection and management of rates are done by two separate bodies within one department, presents an overwhelming accountability and management challenge within system. Street Addressing plays a significant role in improving knowledge of the land rates base and simplifying the land taxation system to benefit the rating management team of

Machakos County. A combination of technical descriptive and spatial location of defaulters better than informal descriptive addresses which is hard to trace defaulters. For instance, a rating manager is able to know the precise address, location and addition attribute information of tax defaulters (on a GIS platform) which will enable the officials to develop policies and legal action measures to make the defaulters accountable. The resulting map (figure 19) has been generated by drawing information from the rates payment inventory from year 2016 to 2017 within the study area.

Contrary to the receipt file system and the Excel system used in Machakos County to store and manage their land rates records, this system gives the management and monitoring officers ability to visualize and perform analysis on rates payment status on a GIS platform even without going physically on the ground to do inspections. Therefore, incorporation of street addressing makes the rating process efficient and more effective in improving collection of the land rates. This spatially related information is important in making rational managerial decisions.

4.5 Street Address Index Register

A street index address is a table grid that enables location of properties and streets. As earlier noted, the study embarked on sequential property numbering system in developing the addresses. The study was able to populate attributes and generate an address index that was able to link specific address of a plot to the plot number, frontage road code for each plot, land use, rateability status, rate payment standing, area size of plot, and centroid coordinates. Table 7 is a resulting sample street address index for land rates management for the study area.

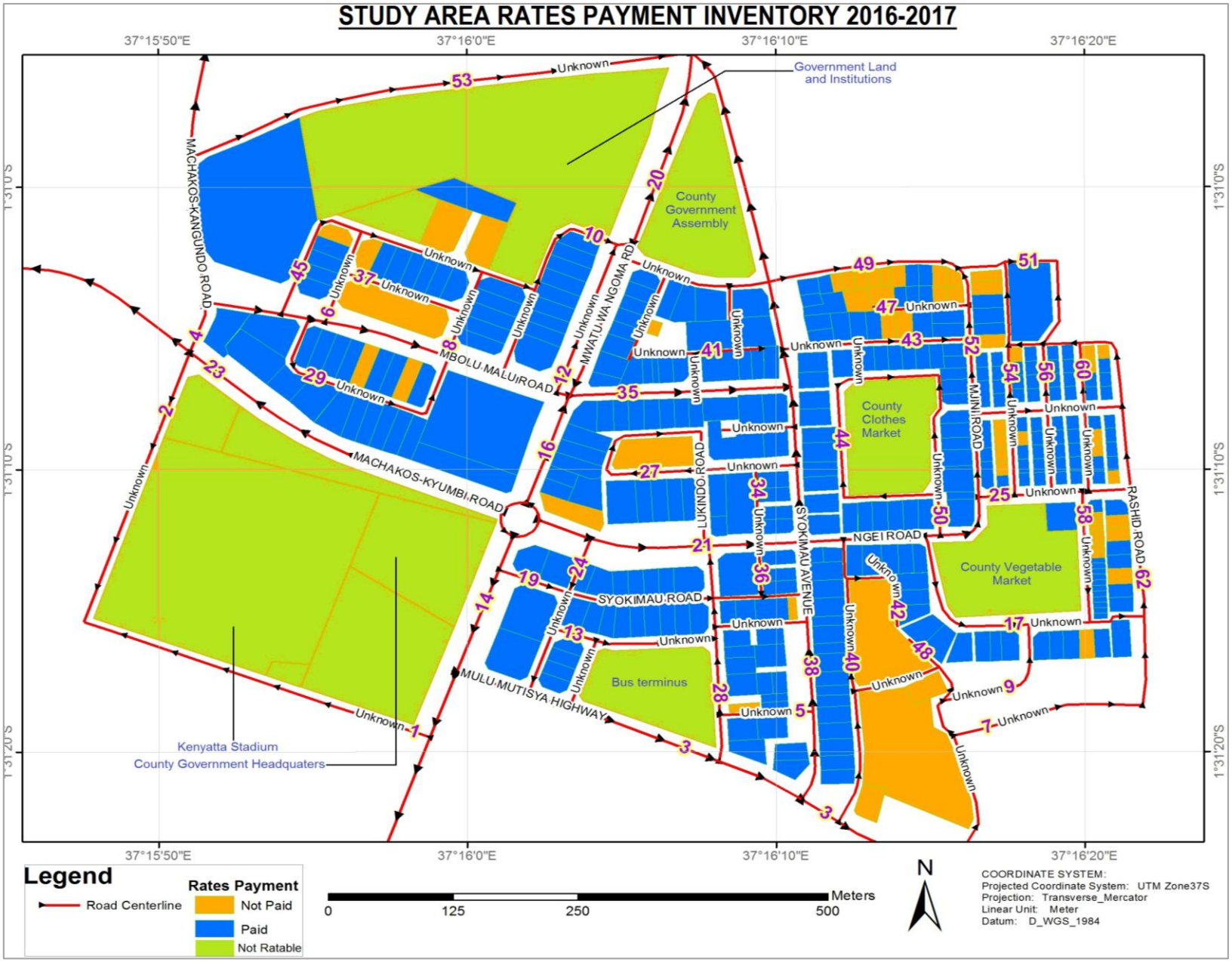


Figure 19: Map on rates payment-per-plot inventory

Table 7: Sample of Street Address Index for management of land rates for Machakos CBD

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateablity Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 1 -Rd 63	254	63	Commercial	Ratable	Paid	367.2856997	(307460.081,9831745.307)
ADR 10-Rd 16	89	16	Commercial	Ratable	Paid	461.5347442	(307281.920,9832012.047)
ADR 11-Rd 21	100	21	Commercial	Ratable	Paid	675.4469148	(307385.730,9831946.047)
ADR 11-Rd 3	733	3	Industrial	Ratable	Not Paid	729.1792444	(307565.500,9831615.773)
ADR 12-Rd 56	176	56	Residential	Ratable	Paid	167.9627509	(307751.123,9832060.450)
ADR 13-Rd 16	55	12	Commercial	Ratable	Paid	652.7292368	(307263.811,9832196.678)
ADR 13-Rd 18	68	18	Commercial	Ratable	Paid	912.1424995	(307305.827,9832091.363)
ADR 14-Rd 38	241	38	Commercial	Ratable	Paid	447.9015866	(307527.558,9831750.681)
ADR 14-Rd 43	126	43	Mixed Use	Ratable	Paid	375.7365647	(307632.105,9832101.037)
ADR 15-Rd 56	163	56	Residential	Ratable	Paid	184.6455094	(307727.276,9832088.462)
ADR 15-Rd 58	206	58	Residential	Ratable	Not Paid	75.23214241	(307793.387,9831891.963)
ADR 16-Rd 56	178	56	Residential	Ratable	Paid	169.7621831	(307749.292,9832089.960)
ADR 16-Rd 60	543	60	Residential	Ratable	Not Paid	191.5575883	(307785.222,9832090.517)
ADR 52-Rd 21	220	21	Markets	Not Ratable	Not Paid	13612.22711	(307707.330,9831872.517)
ADR 2- Rd 14	638	14	Public Purpose	Not Ratable	Not Paid	12490.4138	(307118.099,9831886.311)
ADR 17-Rd 60	180	60	Residential	Ratable	Paid	177.9768311	(307763.446,9832105.723)
ADR 17-Rd 62	198	62	Residential	Ratable	Not Paid	161.403821	(307809.654,9831969.856)
ADR 18-Rd 17	435	17	Residential	Ratable	Paid	433.3116357	(307705.715,9831786.291)
ADR 18-Rd 21	264	21	Commercial	Ratable	Paid	1600.937255	(307433.452,9831863.753)
ADR 18-Rd 23	91	23	Commercial	Ratable	Paid	785.8566657	(306982.315,9832071.771)
ADR 20-Rd 52	490	52	Residential	Ratable	Paid	416.1596508	(307682.391,9832160.937)
ADR 20-Rd 54	458	54	School	Ratable	Paid	3320.09686	(307725.636,9832162.069)
ADR 21-Rd 21	225	21	Commercial	Ratable	Paid	449.6434714	(307575.722,9831927.322)
ADR 21-Rd 35	74	35	Commercial	Ratable	Paid	1221.993761	(307415.395,9832090.100)
ADR 4-Rd 37	68	37	Mixed Use	Ratable	Paid	485.0061288	(307134.585,9832184.447)
ADR 4-Rd 38	10	38	Commercial	Ratable	Paid	483.4081166	(307531.678,9831679.311)
ADR 4-Rd 4	44	4	School	Ratable	Paid	15057.65858	(306952.643,9832267.299)
ADR 4-Rd 40	732	40	Informal Settlement	Not Ratable	Not Paid	5882.881673	(307575.205,9831796.384)
ADR 4-Rd 43	121	43	Mixed Use	Ratable	Paid	363.6680642	(307563.026,9832098.700)

The above sample street address index was generated from the GIS-database created for the study. A comprehensive street address index register has been displayed as appendix 2 in the appendices. The results of the street address index have also displayed on a sample map shown figure 20.

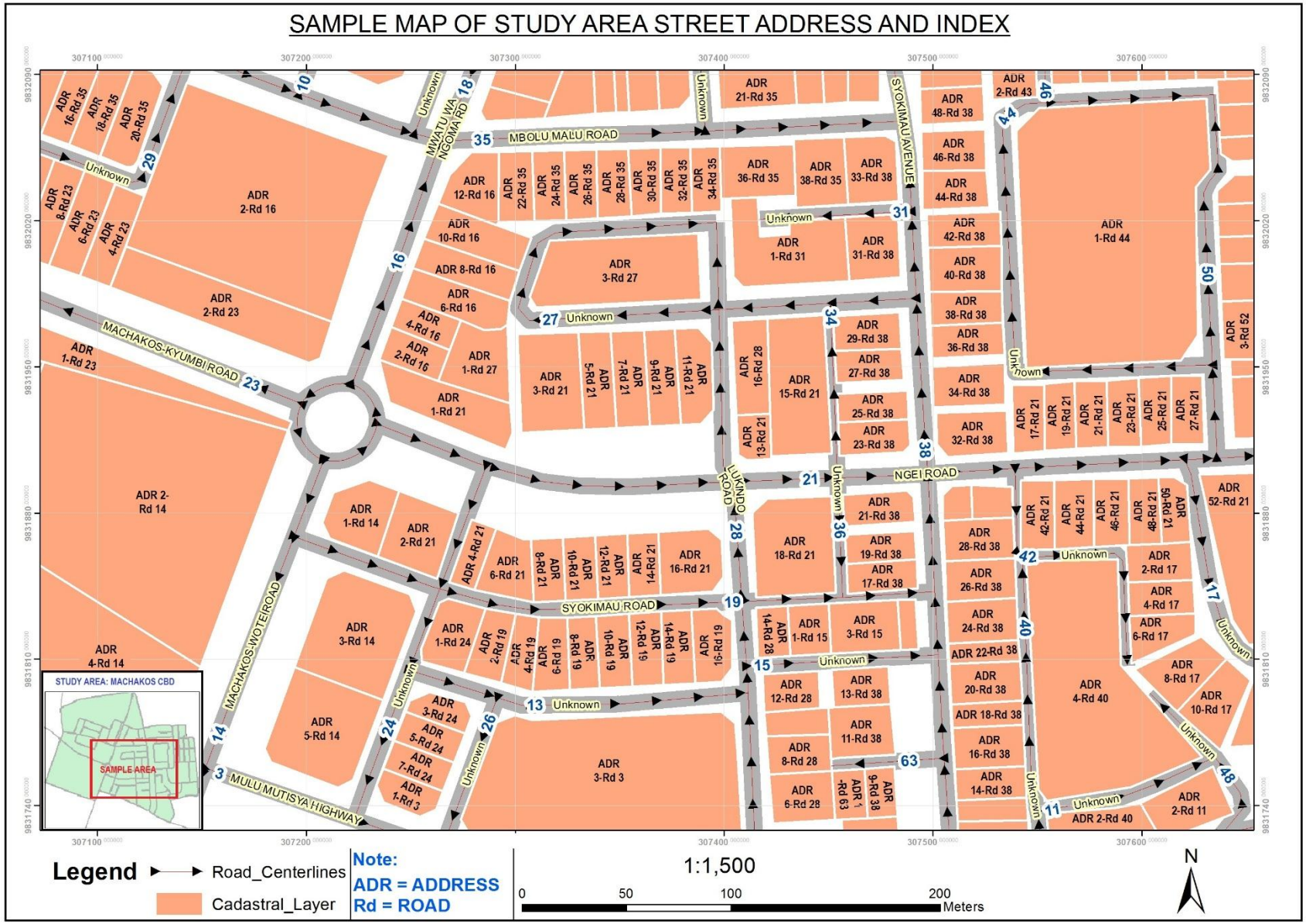


Figure 20: Sample Street Address and Index Map

4.6 Summary of Study Findings

The study findings have been summarized using the study objectives as illustrated in the table 8 below.

Table 8: Summary of Study findings using objectives

Objective 1: To codify streets and assign addresses to land parcels/plots (unique identifiers) within the study area.
Finding summary • The study found out that streets within Machakos Town CBD were grid-locked hence a justifiable reason for application of sequential system of numbering of properties. • The study defined reference point (point zero) and start and end point of every street within the study area. • From the study N-S (North-South) streets were coded with odd numbers while W-E (West-East) streets even numbers conforming to point zero. • The study assigned even numbers to properties on the right side such as 2, 4, 6, and so on and odd numbers on the left 1, 3, 5, and so on.
Objective 2: To do a comprehensive land rates inventory register using a GIS-based street addressing in the study area.
Finding summary • Machakos County rating department uses Excel sheets and receipt system in recording, storage and management of rates data. • The attributes in the Excel sheets recorded by the county government are limited to: Name of plot owner, plot L.R number, amount paid and amount unpaid. The system lacks proper property identification. • The GIS based addressing system incorporates the aforementioned attributes with: address, road frontage code/name and plot centroid coordinates to improve in precise location of properties
Objective 3: To design a GIS geo-database of street address index and land rates inventory.
Finding summary • From the study, attributes were populate to the cadastre polygons develop a rich base data for the GIS geo-data base for management of land rates. • The attributes populated include: Plot address, plot number, frontage road code, land use, rateability status, rates payment status, plot area (m^2) and plot centroid coordinates. The attributes for the streets included: road code and name. • A personal geodatabase that was created using ArcGIS software was tested and was successful on querying operation, statistical analysis, editing of attributes and spatial analysis through visualization. • Linkages were made between specific address of a plot to the plot number, frontage road code for each plot, land use, rateability status, rate payment standing, area size of plot, and centroid coordinates. • Using ArcGIS software it was possible to generate a report (table) on street address index and land rates inventory for the area.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The dawn of the 21st century saw the progressive advancement of technology, which is making the world a global village. With today's technology, streets addressing use has expanded to different sectors. Under no circumstance is street addressing system a substitute of the cadastral system. However, from the study, street addressing system can be a perfect complement to the cadastral system since it adds geo-spatial information of precise address location of parcels with features such as streets/ roads that the public can easily relate. The main objective of this project was to design a GIS-based Street addressing system and demonstrate its potentials in management of land rates within the study area. Indeed, the study was able to display that integration of the geo-spatial information component to the properties will enhance systems in Machakos rating department and County Government at large to efficiently collect more rates and track defaulters through improved revenue management systems.

Like other County Governments, Machakos County has high demand for information services, but their Excel sheets and paper-based information storage is limited to effective maintenance, analysis and visualization. Embracing and implementing a GIS-based street addressing system technology is a guaranteed improvement and solution to the above aforementioned limitations not only to tax/rating department but also other departments that deal with geospatial information hence improving on decision making. Since the development of the addressing system was anchored on a GIS platform, the County Government can further benefit in preparation of land use inventory maps for proper planning purposes of the rapid urbanization trends.

The GIS-based Street addressing rating system database is a very good monitoring tool, one is able to query attributes of properties and find their payment status, value, land use and precise address location. Appropriate maintenance and use of the geo-database will enhance improved decision making in service delivery, urban planning and management. It will also improve accountability and reduce leakage of public coffers through collection and management of land rates. The street addressing rates information database system will provide an interactive link between real owners of the plots/properties and monitoring officials therefore making it possible track defaulters: with plot centroid coordinates, the address and frontage street code attributes, the system will ensure precise location of properties with minimal effort.

5.2 Recommendations

Street Addressing is a system meant to bring efficiency, organization and order. Implementation of GIS-based street addressing system for land rates management is guaranteed to facilitate better management and efficient collection of revenue. Machakos County should incorporate GIS-based addressing system not only in the rating department, but also implement it in general public way finding and other departments that depend on geospatial data to improve on general organization and management of the town.

This GIS-based street addressing study was limited to land rates with no precise monetary figures. Machakos County Government has several sources of local revenue, which may not have been focused in the research study. Therefore, further studies can be done on various sources of Machakos County local revenue with emphasis on how GIS-based street addressing system can be incorporated to perform an overhaul improvement of the entire County revenue management system.

The expandability and sustainability nature of GIS-based addressing system should also allow the County Government of Machakos to roll out the system to other towns and urban centers (areas of rapid urban development) to improve on service provision, development and urban planning in the County.

The system can also be used by other counties to improve their rating system while at the same time integrated street addressing to other uses such as way finding, utility service delivery and improve on disaster and emergency response.

REFERENCES

Adebanwi, W., 2012. Glocal naming and shaming: Toponymic (inter) national relations on Lagos and New York's streets. *African Affairs,* 111(445), pp. 640-661.

Anon., 2005. *Plumus County, CA - Code of Ordinance.* [Online]
Available at:
https://www.municode.com/library/ca/plumas_county/codes/code_of_ordinances?nodeId=TIT9PLZO_CH8STADSY
[Accessed 2017 January 2017].

Bird, R. M. and Slack, E., 2002. Land and property taxation around the world. *Property Tax Management and Administration,* IV(3), pp. 31-80.

Bird, R. M. and Slack, N. E., 2004. *International Handbook of Land and Property Taxation.* Cheltenham, UK: Edward Elgar.

CAK, 2016. *Authority rolls out National Addressing System to boost e-commerce and speed disaster response.* [Online]
Available at: http://www.ca.go.ke/index.php/what-we-do/94-news/412-authority-rolls-out-national-addressing-system-to-boost-e-commerce-and-speed-disaster-response

ESRI, 2006. *Environmental Systems Research Institute.* [Online]
Available at:
http://edndoc.esri.com/arcobjects/9.2/NET_Server_Doc/manager/geodatabase/an_overview_of-2050156920/an_ove-2050156920.htm
[Accessed 27 February 2017].

Farvacque-Vitkovic, C. et al., 2005. *Street Addressing and The Management of Cities.* Washington, DC: World Bank.

FIG, 2001. *FIG Website.* [Online]
Available at: https://www.fig.net/standards_network/greeenway_fig2002.pdf.
[Accessed 6 May 2017].

GOG, 2010. *Street Naming and Property Numbering System (Street Addressing System). Operational Guidelines,* Accra, Ghana: Government of Ghana.

GOK, 2010. *The Constitution of Kenya.* Nairobi, Kenya: Government Printer.

GOK, 2011. *Urban Areas and Cities Act,* Nairobi: Government Printer.

GOK, 2012. *(Revised Edition 2012 [1986]). The Rating Act, Chapter 267,* Nairobi: Government Printer.

GOK, 2012. *County Government Act,* Nairobi: Government Printer.

GOK, 2016. *Report of the Auditor-General on the Finacial Statements of Machakos County for the year ended June 2016,* Nairobi, Kenya: Government Printer.

Kelly, R., 2000. Designing a Property Tax Reform Strategy for Sub- Saharan Africa: An Analytical Framework Applied to Kenya. *Public Budgeting and Finance,* 20(4), pp. 36-51.

Khamala, E. and Karimi, B., 2004. *Indoor GIS:*. Nairobi, Kenya, United Nations Environment Programme, pp. 18-22.

MCG, 2017. *Machakos Government.* [Online]
Available at:
http://www.machakosgovernment.com/documents/2015_Machakos_County_Fiscal_Strategy_Paper.pdf [Accessed 17 April 2017].

Mutisya, J. M., 2014. *Effects of an Integrated revenue collection system and challenges facing its implementation in Machakos County*, Nairobi Kenya: (Doctoral dissertation, University of Nairobi).

The University of California, 1992. *Census and You: Monthly News from the U.S. Bureau of the Census.* Califonia: The Bureau.

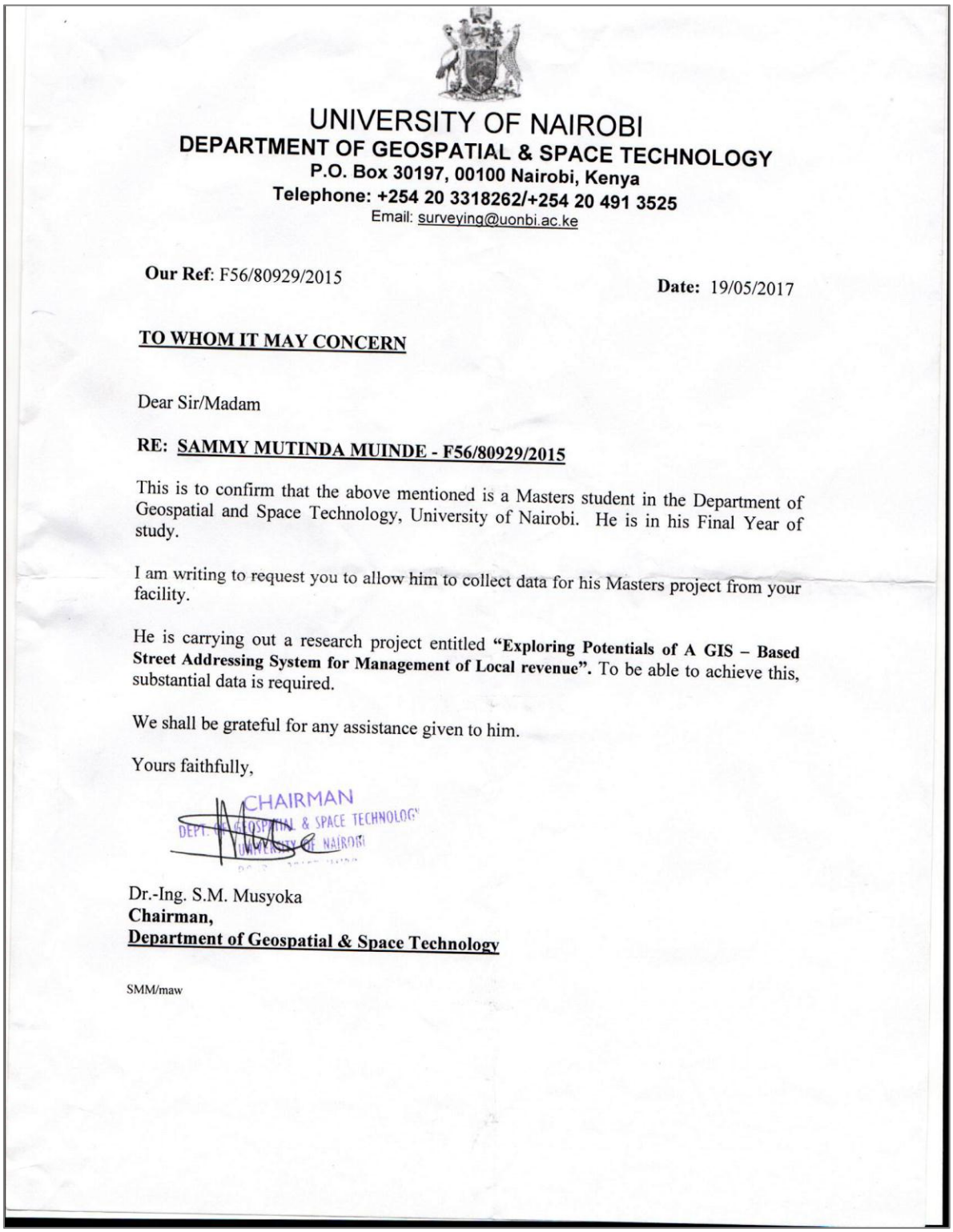
Williams, A., 2014. *Even-Handed Answers for Odd Street Addresses.* [Online]
Available at: http://www.princegeorgecitizen.com/opinion/columnists/even-handed-answers-for-odd-street-addresses-1.1665689 [Accessed 20 February 2017].

World Bank, 2015. *World Urbanization Prospects: The 2014 Revision,* New York: World Bank.

www.gisgeography.com, 2017. *The Remarkable History of GIS.* [Online]
Available at: http://gisgeography.com/history-of-gis/ [Accessed 10 May 2017].

APPENDICES

Appendix 1: University Research Introduction Letter



UNIVERSITY OF NAIROBI
DEPARTMENT OF GEOSPATIAL & SPACE TECHNOLOGY
P.O. Box 30197, 00100 Nairobi, Kenya
Telephone: +254 20 3318262/+254 20 491 3525
Email: surveying@uonbi.ac.ke

Our Ref: F56/80929/2015

Date: 19/05/2017

TO WHOM IT MAY CONCERN

Dear Sir/Madam

RE: SAMMY MUTINDA MUINDE - F56/80929/2015

This is to confirm that the above mentioned is a Masters student in the Department of Geospatial and Space Technology, University of Nairobi. He is in his Final Year of study.

I am writing to request you to allow him to collect data for his Masters project from your facility.

He is carrying out a research project entitled **"Exploring Potentials of A GIS – Based Street Addressing System for Management of Local revenue".** To be able to achieve this, substantial data is required.

We shall be grateful for any assistance given to him.

Yours faithfully,

CHAIRMAN
DEPT. OF GEOSPATIAL & SPACE TECHNOLOGY
UNIVERSITY OF NAIROBI

Dr.-Ing. S.M. Musyoka
Chairman,
Department of Geospatial & Space Technology

SMM/maw

Appendix 2: Comprehensive Street Address Index Register for the study area

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateablity Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 1 -Rd 63	254	63	Commercial	Ratable	Paid	367.2856997	(307460.081,9831745.307)
ADR 10-Rd 16	89	16	Commercial	Ratable	Paid	461.5347442	(307281.920,9832012.047)
ADR 10-Rd 17	431	17	Residential	Ratable	Paid	665.3964887	(307635.711,9831788.968)
ADR 10-Rd 19	271	19	Commercial	Ratable	Paid	502.9767625	(307347.317,9831814.439)
ADR 10-Rd 21	273	21	Commercial	Ratable	Paid	473.0536196	(307331.114,9831853.604)
ADR 10-Rd 23	95	23	Commercial	Ratable	Paid	690.1523434	(307064.391,9832029.339)
ADR 10-Rd 28	586	28	Commercial	Ratable	Paid	374.1711357	(307435.134,9831779.745)
ADR 10-Rd 35	85	29	Commercial	Ratable	Paid	673.5130725	(307045.138,9832096.198)
ADR 10-Rd 37	71	37	Mixed Use	Ratable	Paid	449.8927098	(307092.451,9832199.495)
ADR 10-Rd 38	672	38	Commercial	Ratable	Paid	349.6975764	(307528.538,9831726.511)
ADR 10-Rd 43	124	43	Mixed Use	Ratable	Paid	362.568273	(307604.394,9832100.105)
ADR 10-Rd 47	479	47	Residential	Ratable	Paid	310.04318	(307595.956,9832165.623)
ADR 10-Rd 49	468	49	Residential	Ratable	Not Paid	311.1877041	(307569.226,9832186.878)
ADR 10-Rd 52	142	52	Residential	Ratable	Paid	177.2961639	(307678.204,9832082.249)
ADR 10-Rd 54	157	54	Residential	Ratable	Paid	175.7789737	(307717.012,9832027.062)
ADR 10-Rd 56	175	56	Residential	Ratable	Paid	164.6998949	(307753.281,9832028.438)
ADR 10-Rd 60	193	60	Residential	Ratable	Paid	179.6355423	(307790.397,9832028.997)
ADR 11-Rd 16	56	12	Mixed Use	Ratable	Paid	662.3100887	(307258.156,9832181.834)
ADR 11-Rd 18	67	18	Commercial	Ratable	Paid	599.46016	(307312.616,9832112.037)
ADR 11-Rd 21	100	21	Commercial	Ratable	Paid	675.4469148	(307385.730,9831946.047)
ADR 11-Rd 3	733	3	Industrial	Ratable	Not Paid	729.1792444	(307565.500,9831615.773)
ADR 11-Rd 35	70	35	Commercial	Ratable	Paid	438.1779835	(307328.388,9832083.698)
ADR 11-Rd 38	255	38	Commercial	Ratable	Paid	742.1665745	(307465.605,9831775.560)
ADR 11-Rd 43	484	43	Residential	Ratable	Not Paid	424.3466996	(307599.708,9832135.748)
ADR 11-Rd 52	133	52	Mixed Use	Ratable	Paid	358.9640717	(307651.363,9832034.987)
ADR 11-Rd 54	147	54	Residential	Ratable	Paid	170.8175963	(307695.060,9832053.443)
ADR 11-Rd 56	165	56	Residential	Ratable	Paid	176.5498533	(307729.113,9832058.965)
ADR 11-Rd 58	204	58	Residential	Ratable	Not Paid	79.70673093	(307792.773,9831904.307)
ADR 11-Rd 60	183	60	Residential	Ratable	Paid	177.5680834	(307766.197,9832061.132)
ADR 11-Rd 62	550	62	Residential	Ratable	Not Paid	385.7428488	(307814.004,9831907.633)
ADR 12-Rd 16	88	16	Bank	Ratable	Paid	740.0028682	(307280.702,9832036.130)
ADR 12-Rd 17	432	17	Residential	Ratable	Paid	729.4422303	(307657.254,9831783.059)
ADR 12-Rd 19	268	19	Commercial	Ratable	Paid	491.1261237	(307362.720,9831815.233)
ADR 12-Rd 21	270	21	Commercial	Ratable	Paid	465.0797184	(307346.436,9831854.640)

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateablity Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 12-Rd 23	94	23	Commercial	Ratable	Paid	667.9775795	(307050.086,9832034.115)
ADR 12-Rd 28	398	28	Mixed Use	Ratable	Paid	480.9999253	(307432.099,9831794.639)
ADR 12-Rd 35	84	29	Commercial	Ratable	Not Paid	698.7023793	(307059.409,9832091.065)
ADR 12-Rd 37	72	37	Mixed Use	Ratable	Paid	473.821856	(307077.313,9832204.748)
ADR 12-Rd 38	242	38	Commercial	Ratable	Paid	457.6269145	(307528.383,9831737.966)
ADR 12-Rd 43	125	43	Mixed Use	Ratable	Paid	373.2373755	(307618.131,9832100.569)
ADR 12-Rd 47	117	47	Residential	Ratable	Not Paid	501.7436049	(307577.519,9832167.043)
ADR 12-Rd 49	469	49	Residential	Ratable	Not Paid	275.7365356	(307580.948,9832188.037)
ADR 12-Rd 52	143	52	Residential	Ratable	Paid	187.1587896	(307677.350,9832097.368)
ADR 12-Rd 54	158	54	Residential	Ratable	Paid	169.6149331	(307714.121,9832058.286)
ADR 12-Rd 56	176	56	Residential	Ratable	Paid	167.9627509	(307751.123,9832060.450)
ADR 12-Rd 60	546	60	Residential	Ratable	Paid	182.5111089	(307787.224,9832060.775)
ADR 13-Rd 16	55	12	Commercial	Ratable	Paid	652.7292368	(307263.811,9832196.678)
ADR 13-Rd 18	68	18	Commercial	Ratable	Paid	912.1424995	(307305.827,9832091.363)
ADR 13-Rd 21	877	21	Commercial	Ratable	Paid	327.009821	(307414.367,9831916.577)
ADR 13-Rd 35	71	35	Commercial	Ratable	Paid	502.4228504	(307342.609,9832086.631)
ADR 13-Rd 38	399	38	Commercial	Ratable	Paid	487.8802417	(307465.522,9831796.845)
ADR 13-Rd 43	485	43	Residential	Ratable	Paid	465.2923134	(307618.010,9832136.155)
ADR 13-Rd 52	131	52	Mixed Use	Ratable	Paid	355.0408122	(307651.386,9832054.915)
ADR 13-Rd 54	146	54	Residential	Ratable	Paid	179.3800539	(307694.264,9832068.189)
ADR 13-Rd 56	164	56	Residential	Ratable	Paid	184.2589716	(307728.225,9832073.487)
ADR 13-Rd 58	205	58	Residential	Ratable	Not Paid	74.41861547	(307793.143,9831898.191)
ADR 13-Rd 60	182	60	Residential	Ratable	Paid	170.6727697	(307765.187,9832075.848)
ADR 13-Rd 62	549	62	Residential	Ratable	Not Paid	364.8180841	(307813.333,9831921.741)
ADR 14-Rd 17	433	17	Residential	Ratable	Paid	396.2288096	(307678.399,9831785.636)
ADR 14-Rd 19	267	19	Commercial	Ratable	Paid	493.0860076	(307377.790,9831815.580)
ADR 14-Rd 21	269	21	Commercial	Ratable	Paid	458.1421993	(307361.558,9831855.453)
ADR 14-Rd 23	93	23	Commercial	Ratable	Paid	949.332234	(307031.507,9832039.812)
ADR 14-Rd 28	258	28	Commercial	Ratable	Paid	373.439221	(307423.330,9831823.133)
ADR 14-Rd 35	83	29	Commercial	Ratable	Paid	681.8911975	(307073.976,9832085.808)
ADR 14-Rd 37	73	37	Mixed Use	Ratable	Not Paid	483.1298331	(307062.187,9832211.052)
ADR 14-Rd 38	241	38	Commercial	Ratable	Paid	447.9015866	(307527.558,9831750.681)
ADR 14-Rd 43	126	43	Mixed Use	Ratable	Paid	375.7365647	(307632.105,9832101.037)
ADR 14-Rd 47	116	47	Residential	Ratable	Not Paid	616.9057336	(307553.257,9832161.466)
ADR 14-Rd 49	470	49	Residential	Ratable	Not Paid	296.8572842	(307593.526,9832188.341)

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateability Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 14-Rd 52	488	52	Residential	Ratable	Not Paid	346.4010822	(307684.381,9832118.723)
ADR 14-Rd 54	159	54	Residential	Ratable	Paid	177.2205475	(307713.385,9832072.917)
ADR 14-Rd 56	177	56	Residential	Ratable	Paid	167.6353353	(307750.198,9832075.099)
ADR 14-Rd 60	544	60	Residential	Ratable	Paid	180.0493579	(307786.291,9832075.551)
ADR 15-Rd 16	54	12	Commercial	Ratable	Paid	677.6804919	(307268.735,9832211.051)
ADR 15-Rd 21	101	21	Commercial	Ratable	Paid	2093.261854	(307435.663,9831940.614)
ADR 15-Rd 35	581	35	Public Purpose	Ratable	Paid	220.5327237	(307350.641,9832086.931)
ADR 15-Rd 38	23	38	Commercial	Ratable	Not Paid	727.9182656	(307487.987,9831826.621)
ADR 15-Rd 43	487	43	Residential	Ratable	Paid	406.0859499	(307644.142,9832129.749)
ADR 15-Rd 52	130	52	Mixed Use	Ratable	Paid	415.2891911	(307650.088,9832068.358)
ADR 15-Rd 54	145	54	Residential	Ratable	Paid	174.4527958	(307693.524,9832083.110)
ADR 15-Rd 56	163	56	Residential	Ratable	Paid	184.6455094	(307727.276,9832088.462)
ADR 15-Rd 58	206	58	Residential	Ratable	Not Paid	75.23214241	(307793.387,9831891.963)
ADR 15-Rd 60	181	60	Residential	Ratable	Paid	171.9061599	(307764.383,9832090.532)
ADR 15-Rd 62	548	62	Residential	Ratable	Paid	427.6889862	(307812.078,9831936.404)
ADR 16-Rd 17	434	17	Residential	Ratable	Paid	381.2173974	(307691.464,9831785.891)
ADR 16-Rd 19	266	19	Commercial	Ratable	Paid	554.660907	(307394.041,9831816.624)
ADR 16-Rd 21	35	21	Commercial	Ratable	Paid	880.431132	(307383.644,9831856.870)
ADR 16-Rd 23	92	23	Commercial	Ratable	Paid	1053.775233	(307009.003,9832055.178)
ADR 16-Rd 28	862	28	Commercial	Ratable	Paid	766.5676011	(307412.974,9831950.234)
ADR 16-Rd 35	82	29	Commercial	Ratable	Paid	702.0959261	(307088.139,9832080.609)
ADR 16-Rd 38	240	38	Commercial	Ratable	Paid	461.2023154	(307526.586,9831768.270)
ADR 16-Rd 43	127	43	Mixed Use	Ratable	Paid	310.5697579	(307650.135,9832108.247)
ADR 16-Rd 49	471	49	Residential	Ratable	Paid	243.4412786	(307607.667,9832189.142)
ADR 16-Rd 52	494	52	Residential	Ratable	Paid	408.4997363	(307683.824,9832131.711)
ADR 16-Rd 54	160	54	Residential	Ratable	Paid	175.9322812	(307712.518,9832087.829)
ADR 16-Rd 56	178	56	Residential	Ratable	Paid	169.7621831	(307749.292,9832089.960)
ADR 16-Rd 60	543	60	Residential	Ratable	Not Paid	191.5575883	(307785.222,9832090.517)
ADR 17-Rd 16	53	12	Commercial	Ratable	Paid	995.1899735	(307276.017,9832224.379)
ADR 17-Rd 21	227	21	Commercial	Ratable	Paid	463.7939321	(307545.550,9831925.398)
ADR 17-Rd 35	530	35	Commercial	Ratable	Paid	206.9174629	(307360.921,9832087.383)
ADR 17-Rd 38	261	38	Commercial	Ratable	Paid	420.4628772	(307475.473,9831849.736)
ADR 17-Rd 52	129	52	Mixed Use	Ratable	Paid	328.6379919	(307649.363,9832082.142)
ADR 17-Rd 54	144	54	Residential	Ratable	Paid	179.4651756	(307692.676,9832098.046)
ADR 17-Rd 56	162	56	Residential	Ratable	Paid	189.1095573	(307726.377,9832103.778)

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateability Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 17-Rd 58	207	58	Residential	Ratable	Not Paid	75.81298804	(307793.470,9831885.299)
ADR 17-Rd 60	180	60	Residential	Ratable	Paid	177.9768311	(307763.446,9832105.723)
ADR 17-Rd 62	198	62	Residential	Ratable	Not Paid	161.403821	(307809.654,9831969.856)
ADR 18-Rd 17	435	17	Residential	Ratable	Paid	433.3116357	(307705.715,9831786.291)
ADR 18-Rd 21	264	21	Commercial	Ratable	Paid	1600.937255	(307433.452,9831863.753)
ADR 18-Rd 23	91	23	Commercial	Ratable	Paid	785.8566657	(306982.315,9832071.771)
ADR 18-Rd 35	81	29	Commercial	Ratable	Not Paid	711.1800072	(307102.223,9832075.274)
ADR 18-Rd 38	239	38	Commercial	Ratable	Paid	444.1738815	(307526.042,9831783.594)
ADR 18-Rd 49	472	49	Residential	Ratable	Paid	304.2239151	(307621.080,9832189.270)
ADR 18-Rd 52	489	52	Residential	Ratable	Paid	436.4552128	(307683.075,9832146.246)
ADR 18-Rd 54	161	54	Residential	Ratable	Not Paid	185.104871	(307711.662,9832103.090)
ADR 18-Rd 56	179	56	Residential	Ratable	Paid	169.6223203	(307748.399,9832105.050)
ADR 18-Rd 60	540	60	Residential	Ratable	Not Paid	183.8416825	(307784.338,9832105.474)
ADR 19-Rd 21	226	21	Commercial	Ratable	Paid	469.5168664	(307560.684,9831926.400)
ADR 19-Rd 35	73	35	Commercial	Ratable	Paid	426.1293416	(307375.648,9832088.644)
ADR 19-Rd 38	262	38	Commercial	Ratable	Paid	419.6807866	(307474.737,9831863.704)
ADR 19-Rd 52	128	52	Mixed Use	Ratable	Paid	297.2054913	(307650.769,9832094.867)
ADR 19-Rd 58	208	58	Residential	Ratable	Paid	69.82389789	(307793.690,9831879.068)
ADR 19-Rd 62	197	62	Residential	Ratable	Paid	173.228591	(307808.635,9831984.741)
ADR 1-Rd 10	65	10	Mixed Use	Ratable	Paid	723.4130139	(307180.028,9832130.568)
ADR 1-Rd 14	281	14	Commercial	Ratable	Paid	954.9146978	(307226.116,9831878.836)
ADR 1-Rd 15	259	15	Commercial	Ratable	Paid	372.5304573	(307440.839,9831824.168)
ADR 1-Rd 18	62	18	Commercial	Ratable	Paid	423.4778662	(307340.756,9832185.227)
ADR 1-Rd 2	101	2	Recreation	Not Ratable	Not Paid	47326.2284	(306929.301,9831882.316)
ADR 1-Rd 20	9	20	Public Purpose	Ratable	Not Paid	46639.39966	(307186.106,9832319.120)
ADR 1-Rd 21	94	21	Transport	Not Ratable	Not Paid	1109.222712	(307268.627,9831931.713)
ADR 1-Rd 22	789	22	Commercial	Ratable	Not Paid	199.1747557	(307347.801,9832132.270)
ADR 1-Rd 23	101	23	Public Purpose	Not Ratable	Not Paid	4691.679007	(307011.862,9831985.304)
ADR 1-Rd 24	278	24	Commercial	Ratable	Paid	563.3379105	(307269.006,9831821.658)
ADR 1-Rd 27	95	27	Commercial	Ratable	Paid	865.1644609	(307282.799,9831952.398)
ADR 1-Rd 3	287	3	Commercial	Ratable	Paid	429.0127813	(307248.643,9831745.573)
ADR 1-Rd 31	732	31	Commercial	Ratable	Paid	2624.74628	(307430.040,9832006.079)
ADR 1-Rd 35	78	35	Commercial	Ratable	Paid	416.4667277	(307008.562,9832175.017)
ADR 1-Rd 38	250	38	Commercial	Ratable	Paid	609.6106639	(307486.597,9831670.921)
ADR 1-Rd 41	738	41	Commercial	Ratable	Paid	1649.977772	(307405.235,9832124.071)

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateablity Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 1-Rd 43	493	43	Mixed Use	Ratable	Paid	335.6103798	(307516.568,9832123.520)
ADR 1-Rd 44	36	44	Markets	Not Ratable	Not Paid	14927.14167	(307585.003,9832015.067)
ADR 1-Rd 45	519	45	Public Purpose	Ratable	Not Paid	2362.619661	(307097.167,9832260.595)
ADR 1-Rd 47	486	47	Residential	Ratable	Paid	385.3068042	(307643.576,9832144.164)
ADR 1-Rd 52	137	52	Commercial	Ratable	Paid	361.8665832	(307655.804,9831949.639)
ADR 1-Rd 54	152	54	Residential	Ratable	Paid	164.0757919	(307698.439,9831964.611)
ADR 1-Rd 56	170	56	Residential	Ratable	Paid	164.8378257	(307735.465,9831967.750)
ADR 1-Rd 58	199	58	Residential	Ratable	Paid	150.7882128	(307791.245,9831938.270)
ADR 1-Rd 6	77	6	Mixed Use	Ratable	Paid	472.1294801	(307014.742,9832189.828)
ADR 1-Rd 60	188	60	Residential	Ratable	Paid	172.6628745	(307771.968,9831969.440)
ADR 1-Rd 62	555	62	Residential	Ratable	Paid	325.3404691	(307817.356,9831831.246)
ADR 2- Rd 14	638	14	Public Purpose	Not Ratable	Not Paid	12490.4138	(307118.099,9831886.311)
ADR 2 -Rd 25	219	25	Commercial	Ratable	Paid	908.0532328	(307756.916,9831926.826)
ADR 20-Rd 17	436	17	Residential	Ratable	Paid	405.0107571	(307737.376,9831785.853)
ADR 20-Rd 23	90	23	Commercial	Ratable	Paid	1795.421519	(306949.959,9832101.199)
ADR 20-Rd 35	80	29	Commercial	Ratable	Paid	653.6500868	(307117.051,9832069.093)
ADR 20-Rd 38	238	38	Commercial	Ratable	Paid	448.2118823	(307525.092,9831798.880)
ADR 20-Rd 49	473	49	Residential	Ratable	Not Paid	318.6820751	(307635.032,9832188.372)
ADR 20-Rd 52	490	52	Residential	Ratable	Paid	416.1596508	(307682.391,9832160.937)
ADR 20-Rd 54	458	54	School	Ratable	Paid	3320.09686	(307725.636,9832162.069)
ADR 21-Rd 21	225	21	Commercial	Ratable	Paid	449.6434714	(307575.722,9831927.322)
ADR 21-Rd 35	74	35	Commercial	Ratable	Paid	1221.993761	(307415.395,9832090.100)
ADR 21-Rd 38	263	38	Commercial	Ratable	Paid	462.0264767	(307473.879,9831882.193)
ADR 21-Rd 58	209	58	Residential	Ratable	Paid	68.5077967	(307794.105,9831873.153)
ADR 21-Rd 62	196	62	Residential	Ratable	Paid	171.4441969	(307807.578,9832000.214)
ADR 22-Rd 17	437	17	Residential	Ratable	Paid	476.7077126	(307752.107,9831786.945)
ADR 22-Rd 35	87	35	Commercial	Ratable	Paid	502.2947758	(307300.343,9832036.031)
ADR 22-Rd 38	237	38	Commercial	Ratable	Paid	459.6284877	(307524.460,9831813.432)
ADR 22-Rd 49	474	49	Mixed Use	Ratable	Not Paid	230.670686	(307649.196,9832185.534)
ADR 22-Rd 52	491	52	Residential	Ratable	Not Paid	427.2629328	(307681.564,9832175.489)
ADR 23-Rd 21	224	21	Commercial	Ratable	Paid	455.8028825	(307591.232,9831927.834)
ADR 23-Rd 35	75	35	Commercial	Ratable	Paid	468.0892908	(307440.386,9832091.569)
ADR 23-Rd 38	105	38	Commercial	Ratable	Paid	481.4918316	(307471.519,9831916.354)
ADR 23-Rd 58	210	58	Residential	Ratable	Paid	91.55922266	(307794.372,9831867.169)
ADR 23-Rd 62	195	62	Residential	Ratable	Paid	164.4015807	(307806.527,9832015.432)

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateablity Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 24-Rd 17	438	17	Residential	Ratable	Paid	454.3933051	(307767.031,9831787.574)
ADR 24-Rd 35	86	35	Commercial	Ratable	Paid	472.1617464	(307316.245,9832036.833)
ADR 24-Rd 38	236	38	Commercial	Ratable	Paid	435.2474402	(307523.515,9831828.412)
ADR 24-Rd 52	492	52	Residential	Ratable	Not Paid	466.6614691	(307680.770,9832190.938)
ADR 25-Rd 21	223	21	Commercial	Ratable	Paid	452.8320459	(307606.419,9831929.019)
ADR 25-Rd 35	76	35	Commercial	Ratable	Paid	311.8089508	(307453.057,9832092.480)
ADR 25-Rd 38	134	38	Commercial	Ratable	Paid	473.3491984	(307471.122,9831931.093)
ADR 25-Rd 58	211	58	Residential	Ratable	Paid	76.07806812	(307794.497,9831861.133)
ADR 25-Rd 62	194	62	Residential	Ratable	Paid	157.5585833	(307805.477,9832030.155)
ADR 26-Rd 17	439	17	Residential	Ratable	Not Paid	464.0586531	(307782.733,9831788.011)
ADR 26-Rd 35	85	35	Commercial	Ratable	Paid	481.8295756	(307331.462,9832037.446)
ADR 26-Rd 38	235	38	Commercial	Ratable	Paid	458.4063498	(307522.629,9831848.050)
ADR 27-Rd 21	222	21	Commercial	Ratable	Paid	442.439141	(307621.589,9831929.214)
ADR 27-Rd 38	103	38	Commercial	Ratable	Paid	463.562013	(307469.303,9831950.681)
ADR 27-Rd 58	212	58	Residential	Ratable	Paid	74.97054365	(307794.804,9831855.074)
ADR 27-Rd 62	547	62	Residential	Ratable	Paid	177.747967	(307802.211,9832061.121)
ADR 28-Rd 17	440	17	Residential	Ratable	Paid	434.6996448	(307798.056,9831789.062)
ADR 28-Rd 35	84	35	Commercial	Ratable	Paid	465.9721007	(307346.936,9832037.850)
ADR 28-Rd 38	234	38	Commercial	Ratable	Paid	668.3210441	(307521.920,9831867.473)
ADR 29-Rd 21	221	21	Commercial	Ratable	Paid	865.0473191	(307656.472,9831931.100)
ADR 29-Rd 38	102	38	Commercial	Ratable	Paid	487.2523883	(307468.557,9831966.759)
ADR 29-Rd 58	213	58	Residential	Ratable	Paid	83.09189946	(307795.192,9831849.075)
ADR 29-Rd 62	545	62	Residential	Ratable	Paid	174.1191818	(307801.197,9832075.948)
ADR 2-Rd 11	678	11	Mixed Use	Ratable	Not Paid	753.9308019	(307622.064,9831740.126)
ADR 2-Rd 16	93	16	Commercial	Ratable	Paid	488.5789064	(307251.740,9831956.076)
ADR 2-Rd 16	99	16	Public Purpose	Not Ratable	Not Paid	8078.742094	(307176.679,9832029.115)
ADR 2-Rd 17	427	17	Residential	Ratable	Paid	547.7405975	(307608.341,9831856.437)
ADR 2-Rd 19	277	19	Commercial	Ratable	Paid	511.6228872	(307288.531,9831816.767)
ADR 2-Rd 20	67	20	Public Purpose	Not Ratable	Not Paid	13494.95327	(307395.885,9832265.398)
ADR 2-Rd 21	280	21	Commercial	Ratable	Paid	1147.596624	(307253.533,9831869.615)
ADR 2-Rd 23	88	23	Public Purpose	Ratable	Paid	1796.601005	(307159.719,9831979.467)
ADR 2-Rd 28	252	28	Commercial	Ratable	Paid	717.461897	(307437.914,9831695.977)
ADR 2-Rd 35	89	35	Commercial	Ratable	Paid	1635.725313	(306967.287,9832127.643)
ADR 2-Rd 37	67	37	Mixed Use	Ratable	Paid	466.3674922	(307150.623,9832178.269)
ADR 2-Rd 38	888	38	Commercial	Ratable	Paid	213.9449554	(307532.803,9831659.280)

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateablity Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 2-Rd 4	531	23	Commercial	Ratable	Paid	878.9127843	(306919.368,9832130.582)
ADR 2-Rd 40	732	40	Industrial	Not Ratable	Not Paid	9974.89899	(307607.728,9831666.030)
ADR 2-Rd 43	40	43	Commercial	Ratable	Paid	14927.14167	(307538.428,9832093.297)
ADR 2-Rd 47	475	47	Mixed Use	Ratable	Not Paid	202.0259225	(307650.979,9832167.737)
ADR 2-Rd 49	61	49	Commercial	Ratable	Paid	610.1141281	(307364.853,9832163.063)
ADR 2-Rd 49	464	49	Residential	Ratable	Paid	265.9904666	(307520.818,9832178.971)
ADR 2-Rd 52	138	52	Residential	Ratable	Paid	356.2847445	(307682.928,9831971.972)
ADR 2-Rd 54	153	54	Residential	Ratable	Paid	154.9958613	(307720.122,9831967.145)
ADR 2-Rd 56	171	56	Residential	Ratable	Paid	156.4068835	(307756.953,9831968.779)
ADR 2-Rd 60	189	60	Residential	Ratable	Paid	173.5648652	(307794.383,9831969.468)
ADR 30-Rd 17	441	17	Residential	Ratable	Paid	629.5679611	(307816.980,9831794.067)
ADR 30-Rd 35	83	35	Commercial	Ratable	Paid	480.978585	(307362.169,9832038.972)
ADR 30-Rd 38	881	38	Commercial	Ratable	Paid	223.33214	(307511.832,9831884.659)
ADR 31-Rd 38	879	38	Commercial	Ratable	Paid	337.2135275	(307471.298,9832007.348)
ADR 31-Rd 58	214	58	Residential	Ratable	Paid	75.35351285	(307795.514,9831842.901)
ADR 31-Rd 62	542	62	Residential	Ratable	Paid	179.4223444	(307800.285,9832090.987)
ADR 32-Rd 35	82	35	Commercial	Ratable	Paid	468.1460349	(307376.883,9832039.344)
ADR 32-Rd 38	106	38	Commercial	Ratable	Paid	710.2930271	(307518.777,9831918.329)
ADR 33-Rd 38	78	38	Commercial	Ratable	Paid	746.8964765	(307470.433,9832044.487)
ADR 33-Rd 58	215	58	Residential	Ratable	Paid	67.73205986	(307795.864,9831836.794)
ADR 33-Rd 62	541	62	Residential	Ratable	Not Paid	172.2796829	(307799.252,9832106.086)
ADR 34-Rd 35	81	35	Commercial	Ratable	Paid	454.1619772	(307391.245,9832039.794)
ADR 34-Rd 38	107	38	Commercial	Ratable	Paid	594.3617999	(307517.213,9831941.221)
ADR 35-Rd 38	77	38	Commercial	Ratable	Paid	606.15139	(307466.824,9832094.493)
ADR 35-Rd 58	216	58	Residential	Ratable	Paid	78.15920237	(307796.108,9831830.854)
ADR 36-Rd 35	725	35	Commercial	Ratable	Paid	949.680149	(307415.908,9832043.741)
ADR 36-Rd 38	108	38	Commercial	Ratable	Paid	488.9857585	(307516.313,9831962.757)
ADR 37-Rd 38	57	38	Commercial	Ratable	Paid	927.4222204	(307451.444,9832127.451)
ADR 37-Rd 58	217	58	Residential	Ratable	Paid	76.69284158	(307796.357,9831824.815)
ADR 38-Rd 35	878	35	Commercial	Ratable	Paid	505.9332583	(307446.004,9832043.214)
ADR 38-Rd 38	109	38	Commercial	Ratable	Paid	456.1297569	(307515.499,9831978.303)
ADR 39-Rd 38	58	38	Bank	Ratable	Paid	1184.549691	(307445.457,9832158.580)
ADR 39-Rd 58	218	58	Residential	Ratable	Paid	74.01565558	(307796.509,9831818.676)
ADR 3-Rd 10	64	10	Mixed Use	Ratable	Paid	740.1654092	(307185.527,9832145.258)
ADR 3-Rd 14	282	14	Petrol Station	Ratable	Paid	2325.49811	(307224.396,9831822.330)

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateablity Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 3-Rd 15	260	15	Commercial	Ratable	Paid	727.9182656	(307467.130,9831825.559)
ADR 3-Rd 16	60	12	Commercial	Ratable	Paid	691.3980717	(307238.022,9832125.923)
ADR 3-Rd 18	63	18	Commercial	Ratable	Paid	434.4714631	(307335.350,9832170.417)
ADR 3-Rd 21	96	21	Commercial	Ratable	Paid	1420.687823	(307316.745,9831942.608)
ADR 3-Rd 23	755	23	Public Purpose	Not Ratable	Not Paid	3861.96083	(306897.020,9832036.573)
ADR 3-Rd 24	284	24	Commercial	Ratable	Paid	364.3479743	(307264.738,9831785.269)
ADR 3-Rd 27	45	27	Recreation	Not Ratable	Not Paid	1351.535896	(307349.659,9831995.917)
ADR 3-Rd 3	15	3	Transport	Not Ratable	Not Paid	2806.660133	(307381.124,9831716.116)
ADR 3-Rd 35	546	35	Mixed Use	Not Ratable	Not Paid	3294.998781	(307088.711,9832152.984)
ADR 3-Rd 38	251	38	Commercial	Ratable	Paid	735.6610631	(307467.763,9831697.843)
ADR 3-Rd 43	483	43	Residential	Ratable	Paid	422.0495351	(307536.575,9832133.784)
ADR 3-Rd 45	520	45	Public Purpose	Ratable	Not Paid	1397.600772	(307140.274,9832247.827)
ADR 3-Rd 52	138	52	Mixed Use	Ratable	Paid	417.6155797	(307653.941,9831967.703)
ADR 3-Rd 54	151	54	Residential	Ratable	Not Paid	181.415099	(307697.734,9831979.067)
ADR 3-Rd 56	169	56	Residential	Ratable	Paid	171.7685975	(307734.650,9831982.416)
ADR 3-Rd 58	200	58	Residential	Ratable	Not Paid	89.44252634	(307791.377,9831928.594)
ADR 3-Rd 6	76	6	Mixed Use	Ratable	Paid	455.1382003	(307019.752,9832204.302)
ADR 3-Rd 60	187	60	Residential	Ratable	Paid	181.5467312	(307771.101,9831984.304)
ADR 3-Rd 62	554	62	Residential	Ratable	Paid	332.8394536	(307816.567,9831846.446)
ADR 40-Rd 21	882	21	Commercial	Ratable	Paid	237.5299185	(307528.114,9831885.355)
ADR 40-Rd 38	110	38	Commercial	Ratable	Paid	647.3146471	(307515.381,9831996.862)
ADR 42-Rd 21	232	21	Commercial	Ratable	Paid	472.3720682	(307550.012,9831879.048)
ADR 42-Rd 38	111	38	Commercial	Ratable	Paid	516.3572493	(307514.894,9832015.654)
ADR 44-Rd 21	231	21	Commercial	Ratable	Paid	442.8291757	(307567.399,9831879.691)
ADR 44-Rd 38	112	38	Public Purpose	Not Ratable	Not Paid	558.8989753	(307510.406,9832034.897)
ADR 46-Rd 21	230	21	Commercial	Ratable	Paid	466.4884891	(307585.291,9831880.414)
ADR 46-Rd 38	113	38	Commercial	Ratable	Paid	589.8862009	(307509.926,9832053.654)
ADR 48-Rd 21	229	21	Commercial	Ratable	Paid	473.2816183	(307601.189,9831880.830)
ADR 48-Rd 38	114	38	Commercial	Ratable	Paid	585.3485241	(307509.061,9832075.265)
ADR 4-Rd 14	600	14	Public Purpose	Not Ratable	Not Paid	15408.22036	(307072.587,9831781.012)
ADR 4-Rd 16	92	16	Commercial	Ratable	Paid	444.2819644	(307257.303,9831970.533)
ADR 4-Rd 17	428	17	Residential	Ratable	Paid	472.6835884	(307609.209,9831839.351)
ADR 4-Rd 19	496	19	Commercial	Ratable	Paid	377.345004	(307303.273,9831813.152)
ADR 4-Rd 21	279	21	Commercial	Ratable	Paid	451.1984232	(307279.047,9831861.464)
ADR 4-Rd 23	98	23	Commercial	Ratable	Paid	685.8962523	(307107.202,9832012.744)

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateability Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 4-Rd 28	396	28	Commercial	Ratable	Not Paid	247.3028067	(307439.832,9831718.854)
ADR 4-Rd 35	88	29	Commercial	Ratable	Paid	637.8730174	(307002.610,9832111.688)
ADR 4-Rd 37	68	37	Mixed Use	Ratable	Paid	485.0061288	(307134.585,9832184.447)
ADR 4-Rd 38	10	38	Commercial	Ratable	Paid	483.4081166	(307531.678,9831679.311)
ADR 4-Rd 4	44	4	School	Ratable	Paid	15057.65858	(306952.643,9832267.299)
ADR 4-Rd 40	732	40	Informal Settlement	Not Ratable	Not Paid	5882.881673	(307575.205,9831796.384)
ADR 4-Rd 43	121	43	Mixed Use	Ratable	Paid	363.6680642	(307563.026,9832098.700)
ADR 4-Rd 47	476	47	Residential	Ratable	Not Paid	297.253674	(307635.258,9832168.025)
ADR 4-Rd 49	60	49	Commercial	Ratable	Paid	764.4356246	(307380.368,9832156.158)
ADR 4-Rd 49	465	49	Residential	Ratable	Not Paid	224.3147796	(307532.361,9832181.045)
ADR 4-Rd 52	139	52	Residential	Ratable	Paid	178.2112273	(307681.902,9831994.026)
ADR 4-Rd 54	154	54	Residential	Ratable	Paid	162.4339487	(307719.387,9831981.808)
ADR 4-Rd 56	172	56	Residential	Ratable	Paid	172.480194	(307756.045,9831983.481)
ADR 4-Rd 60	190	60	Residential	Ratable	Paid	198.7756385	(307793.441,9831984.404)
ADR 50-Rd 21	228	21	Commercial	Ratable	Paid	451.4697123	(307615.311,9831881.012)
ADR 50-Rd 38	115	38	Commercial	Ratable	Paid	587.0877682	(307508.345,9832094.670)
ADR 52-Rd 21	220	21	Markets	Not Ratable	Not Paid	13612.22711	(307707.330,9831872.517)
ADR 52-Rd 38	462	38	Mixed Use	Ratable	Paid	442.2040699	(307513.360,9832138.359)
ADR 54-Rd 38	841	38	Residential	Ratable	Paid	721.9802733	(307523.378,9832156.831)
ADR 56-Rd 38	481	38	Mixed Use	Ratable	Paid	237.368306	(307506.863,9832162.330)
ADR 58-Rd 38	463	38	Mixed Use	Ratable	Paid	247.4427844	(307504.025,9832177.057)
ADR 5-Rd 10	63	10	Mixed Use	Ratable	Paid	742.2741151	(307191.536,9832159.746)
ADR 5-Rd 14	283	14	Petrol Station	Ratable	Paid	2074.399431	(307207.481,9831776.781)
ADR 5-Rd 16	59	12	Commercial	Ratable	Paid	717.4863464	(307242.427,9832139.143)
ADR 5-Rd 18	64	18	Commercial	Ratable	Paid	472.5737231	(307330.159,9832156.282)
ADR 5-Rd 21	97	21	Commercial	Ratable	Paid	709.7390393	(307339.311,9831943.601)
ADR 5-Rd 24	285	24	Commercial	Ratable	Paid	455.0352778	(307259.029,9831772.782)
ADR 5-Rd 3	491	3	Commercial	Ratable	Paid	731.1722573	(307444.938,9831673.576)
ADR 5-Rd 35	66	35	Public Purpose	Ratable	Paid	689.7352882	(307174.389,9832116.625)
ADR 5-Rd 38	394	38	Commercial	Ratable	Paid	255.6628668	(307470.485,9831720.594)
ADR 5-Rd 43	120	43	Residential	Ratable	Paid	509.6014921	(307553.711,9832134.445)
ADR 5-Rd 45	544	45	Public Purpose	Ratable	Paid	1897.843222	(307166.378,9832272.552)
ADR 5-Rd 52	135	52	Mixed Use	Ratable	Paid	415.2741765	(307652.639,9831990.745)
ADR 5-Rd 54	150	54	Residential	Ratable	Not Paid	181.0183849	(307696.971,9831994.164)
ADR 5-Rd 56	168	56	Residential	Ratable	Paid	169.6062983	(307733.786,9831997.380)

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateablity Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 5-Rd 58	201	58	Residential	Ratable	Not Paid	86.07379347	(307791.811,9831922.407)
ADR 5-Rd 6	75	6	Mixed Use	Ratable	Paid	460.3101826	(307025.653,9832218.864)
ADR 5-Rd 60	186	60	Residential	Ratable	Paid	177.2012576	(307770.223,9831999.228)
ADR 5-Rd 62	553	62	Residential	Ratable	Not Paid	360.9758414	(307815.897,9831862.163)
ADR 6-Rd 16	91	16	Commercial	Ratable	Paid	465.1846477	(307272.177,9831981.643)
ADR 6-Rd 17	429	17	Residential	Ratable	Paid	480.0210322	(307607.983,9831822.628)
ADR 6-Rd 19	437	19	Commercial	Ratable	Paid	533.6109775	(307317.548,9831812.370)
ADR 6-Rd 21	275	21	Commercial	Ratable	Paid	664.3885179	(307296.753,9831854.075)
ADR 6-Rd 23	97	23	Commercial	Ratable	Paid	679.4606719	(307092.709,9832018.666)
ADR 6-Rd 28	253	28	Commercial	Ratable	Paid	706.8336051	(307437.322,9831744.000)
ADR 6-Rd 35	87	29	Commercial	Ratable	Paid	696.9548704	(307016.334,9832106.895)
ADR 6-Rd 37	69	37	Mixed Use	Ratable	Paid	475.6403403	(307120.876,9832189.522)
ADR 6-Rd 38	445	38	Commercial	Ratable	Paid	473.9288912	(307531.374,9831693.663)
ADR 6-Rd 43	122	43	Mixed Use	Ratable	Paid	372.7620186	(307576.772,9832099.171)
ADR 6-Rd 47	477	47	Residential	Ratable	Paid	267.1260677	(307621.395,9832167.544)
ADR 6-Rd 49	59	49	Commercial	Ratable	Paid	996.9244128	(307405.856,9832156.752)
ADR 6-Rd 49	466	49	Residential	Ratable	Not Paid	279.1887438	(307543.948,9832182.952)
ADR 6-Rd 52	140	52	Residential	Ratable	Paid	357.1358944	(307680.977,9832016.190)
ADR 6-Rd 54	155	54	Residential	Ratable	Paid	168.1059332	(307718.611,9831996.797)
ADR 6-Rd 56	173	56	Residential	Ratable	Paid	161.1331079	(307755.136,9831998.446)
ADR 6-Rd 60	191	60	Residential	Ratable	Not Paid	175.2707569	(307792.411,9831999.457)
ADR 7-Rd 10	62	45	Mixed Use	Ratable	Paid	674.6279446	(307197.771,9832173.666)
ADR 7-Rd 16	58	12	Commercial	Ratable	Paid	672.6918019	(307247.017,9832152.636)
ADR 7-Rd 18	65	18	Commercial	Ratable	Paid	448.6905302	(307324.689,9832142.538)
ADR 7-Rd 21	98	21	Commercial	Ratable	Paid	711.1276352	(307354.990,9831944.251)
ADR 7-Rd 24	286	24	Commercial	Ratable	Paid	444.040225	(307253.719,9831759.028)
ADR 7-Rd 3	249	3	Commercial	Ratable	Paid	539.4701944	(307486.388,9831653.752)
ADR 7-Rd 35	61	35	Bank	Ratable	Paid	1667.794476	(307230.338,9832104.808)
ADR 7-Rd 38	395	38	Commercial	Ratable	Paid	235.4547468	(307469.597,9831729.657)
ADR 7-Rd 43	119	43	Residential	Ratable	Paid	500.9423834	(307569.359,9832134.862)
ADR 7-Rd 45	521	45	Public Purpose	Ratable	Not Paid	1202.214721	(307181.791,9832231.998)
ADR 7-Rd 52	132	52	Mixed Use	Ratable	Paid	396.1789028	(307651.943,9832006.152)
ADR 7-Rd 54	149	54	Residential	Ratable	Not Paid	188.9904365	(307696.179,9832009.505)
ADR 7-Rd 56	167	56	Residential	Ratable	Paid	167.856007	(307732.993,9832012.267)
ADR 7-Rd 58	202	58	Residential	Ratable	Not Paid	95.28059565	(307792.153,9831916.318)

ADDRESS	Plot NO.	Frontage Road Code	Land Use	Rateablity Status	Rates Payment	Plot Area (M2)	Plot Centroid Coordinates
ADR 7-Rd 6	74	6	Mixed Use	Ratable	Not Paid	447.1306718	(307031.505,9832233.120)
ADR 7-Rd 60	185	60	Residential	Ratable	Paid	186.5719431	(307769.326,9832014.228)
ADR 7-Rd 62	552	62	Residential	Ratable	Paid	358.2365243	(307815.306,9831878.000)
ADR 8-Rd 16	90	16	Commercial	Ratable	Paid	459.0455406	(307276.624,9831996.672)
ADR 8-Rd 17	430	17	Residential	Ratable	Paid	610.9654314	(307619.174,9831804.256)
ADR 8-Rd 19	272	19	Commercial	Ratable	Paid	476.3757587	(307332.368,9831813.553)
ADR 8-Rd 21	274	21	Commercial	Ratable	Paid	464.0661501	(307315.746,9831852.846)
ADR 8-Rd 23	96	23	Commercial	Ratable	Paid	690.3162172	(307078.398,9832024.141)
ADR 8-Rd 28	829	28	Commercial	Ratable	Paid	542.8367115	(307435.788,9831764.690)
ADR 8-Rd 35	86	29	Commercial	Ratable	Paid	709.0352145	(307030.792,9832101.442)
ADR 8-Rd 37	70	37	Mixed Use	Ratable	Paid	488.45659	(307107.517,9832194.110)
ADR 8-Rd 38	825	38	Commercial	Ratable	Paid	301.0053673	(307529.504,9831711.960)
ADR 8-Rd 43	123	43	Mixed Use	Ratable	Paid	371.8741981	(307590.678,9832099.641)
ADR 8-Rd 47	478	47	Residential	Ratable	Paid	324.5244071	(307608.145,9832166.721)
ADR 8-Rd 49	467	49	Residential	Ratable	Not Paid	299.7769412	(307556.639,9832185.115)
ADR 8-Rd 52	141	52	Residential	Ratable	Paid	348.1335065	(307679.467,9832060.415)
ADR 8-Rd 54	156	54	Residential	Ratable	Not Paid	171.1037449	(307717.812,9832011.898)
ADR 8-Rd 56	174	56	Residential	Ratable	Paid	169.7035258	(307754.218,9832013.336)
ADR 8-Rd 60	192	60	Residential	Ratable	Not Paid	187.7785591	(307791.435,9832014.115)
ADR 9-Rd 16	57	12	Commercial	Ratable	Paid	707.0563845	(307252.354,9832167.040)
ADR 9-Rd 18	66	18	Commercial	Ratable	Paid	458.3963676	(307319.146,9832128.500)
ADR 9-Rd 21	99	21	Commercial	Ratable	Paid	705.3003564	(307370.417,9831944.943)
ADR 9-Rd 3	248	3	Commercial	Ratable	Paid	446.2610823	(307533.323,9831643.757)
ADR 9-Rd 35	69	35	Commercial	Ratable	Paid	214.1956079	(307298.348,9832074.666)
ADR 9-Rd 38	255	38	Commercial	Ratable	Paid	341.5848675	(307475.021,9831746.271)
ADR 9-Rd 43	118	43	Residential	Ratable	Not Paid	608.9891676	(307584.019,9832135.277)
ADR 9-Rd 52	134	52	Mixed Use	Ratable	Paid	397.0049966	(307651.196,9832020.647)
ADR 9-Rd 54	148	54	Residential	Ratable	Not Paid	179.7063534	(307695.373,9832024.721)
ADR 9-Rd 56	166	56	Residential	Ratable	Paid	170.1563275	(307732.105,9832027.270)
ADR 9-Rd 58	203	58	Residential	Ratable	Not Paid	76.06273898	(307792.505,9831910.377)
ADR 9-Rd 60	184	60	Residential	Ratable	Paid	178.9554729	(307768.423,9832029.170)
ADR 9-Rd 62	551	62	Residential	Ratable	Paid	336.8622888	(307814.549,9831892.790)
ARD 2-Rd 1	102	1	Recreation	Not Ratable	Not Paid	800.9958034	(306983.205,9831757.141)