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Analysis of Multi-Purpose Cadastral Using Geo-Spatial Techniques: A Case Study of The Polytechnic Ibadan, Oyo State, Nigeria.

Akeem A. Babatunde Martins, A. Oyekola and Gbola K. Adewuyi*
Department of Surveying and Geoinformatics, The Polytechnic Ibadan

Abstract

Acquisition of Land and its ownership for wealth creation has failed to be attained by the majority of people in both the developing or less developed countries. Majority of the European countries have developed multi-purpose cadastre to be in line with the property ownership. This study investigates a multipurpose cadastre analysis of the Senior Staff Quarters of the North Campus, The Polytechnic Ibadan using geo-spatial techniques. Primary and Secondary data were used for the study. The primary data were acquired through the use of Kolida KTS445L Total Station while the secondary data were acquired through social survey. Information on Spatial database based on the cadastral system, Determination of the location values of buildings, Assessment of the condition of buildings, road and properties present in the area. The results shows that the existing cadastral framework of the study area is insufficient to be used as a reference or guide in the planning and development of the area and also in the making of administrative and management policies such as the formulation of an effective tax system, enrich the public with knowledge on the amount of cadastral features present in the area. There is therefore a need to update and improve the existing cadastral framework of the study area to ensure the effective management of planning and development of the area.

Keywords: Multi-purpose cadastre, Wealth Creation, Property Ownership, Geo-spatial Techniques.

1.0 Introduction

The efficient and effective operation of a nation's cadastral system is an integral part of sustainable development. From Ting, it was argued that land and its use is a source of wealth with the cadastral system as the fiscal tool in recording the ownership of land (Ting, 1999). The evolution and improvement of the cadastral system have made it possible to be used for urban planning and service delivery. The modern cadastre is made up of the cadastral map and the associated registers. Both of the entities represent the graphical and textual component of the cadastral system. With the constant and continuous evolution to meet the demands of the land market, other land information databases containing information such as planning control and the land value assessment are being progressively added onto the modern cadastral system. This modern cadastral system is a step towards the concept of the multipurpose cadastral. Cadastral surveys are surveys that are carried out for the purpose of producing plans; showing property boundaries on which areas necessary for assessment of properties or land taxes may be computed. Information obtained from a cadastral survey is then represented on a cadastral map through the use of conventional symbols.

Subsequently, it is also possible to carry out varieties of analysis on the cadastral information of parcels of land. This was borne out necessitation for search of specific and specialized information by different professionals such as; environmentalists, town planners and developers, administrators, policy makers, corporate bodies and even private individuals.

A multipurpose cadastre is a two dimensional (2D) cadastre that has been adopted by many countries of the world which gives a detailed account consisting of components such as a reference frame in line with geodetic network, the cadastral parcel, accurate large scale maps presenting land parcels within a sector in a district, within a region in the country, a unique parcel identifier within a land information systems (LIS) and a database management system (DBMS) of all land information were stored. The geometric dimensions of the land parcel in 2D is usually a polygon, the acquisition of 2D parcels has not been a problem recently as most computer aided design (CAD) and Geographic Information System (GIS) application software's solve the generation of 2D land parcels. In representing 2D land parcels as 3D volume parcels, it requires a specific spatial data model. This 2D cadastre data model is polygonal in shape, therefore consisting of nodes, edges and the surface (land), and the data is usually in vector format with the spatial information such as the XY coordinates, distances and bearings between the nodes, or the survey beacon. The 3D data model is obtained by the inclusion of depth (Z) to the 2D data model. A volume space will consist of a set of faces which enclose a 3D space representing the 2D land surface as a 3D volume parcel (Stoter, 2004; Abdul Rahman et al, 2011, 2012; Lemmen, 2012)

A multipurpose cadastral is a methodically arranged inventory and representation of data concerning all legal land objects in a certain area, based on the survey of their boundaries. It is an extension of the modern cadastral to include the needs of other users of land information which may include; environmentalists, town planners and developers, administrators, policy makers, government agencies, corporate bodies, private individuals etc.

Within a multipurpose cadastre, maps showing the location of physical and abstractive features (within a parcel) can be easily linked to the information associated with those features. The information that may be linked to land parcels includes; buildings, pipelines, roads, vegetation, water, geology, property and administrative boundaries, land value, and land use. The multipurpose cadastral has been found to be an invaluable tool and basis for the planning and development of parcels of land.

The carrying out of a multipurpose cadastral analysis of the study area will provide the users of the information with the cadastral knowledge and the spatial attributes of each parcel of land to aid in the effective management of planning, administration and development of the area.

1.1 Multipurpose Cadastral Analysis

A multipurpose cadastral analysis is a large-scale, community-oriented land use representation designed to serve both public and private organizations and individual citizens. It defines how a region or a geographical area is divided through legally defined and, usually, geo-referenced boundaries and land ownership (FIG, 1995).

Within a multipurpose cadastre, maps showing the location of physical features (within a parcel) can be easily linked to the information associated with those features. It is concerned with the physical attributes associated with each land parcel, including man-made objects such as buildings, pipelines, roads etc., and natural features such as vegetation, water, or geology. It is also concerned with abstractions such as property and administrative boundaries, land value, and land use.

The following is a list of the various analyses that can be made from a cadastral survey;

i. Provision of a visual site for people to look up property data and history.
ii. Providing for fair market value analysis for planners.
iii. Making an accurate assessment of historic property development and use for mapping historical community development.
iv. Determination of land and structural values associated with natural disasters for emergency management.
v. Provision of accurate parcel data and tax maps
vi. Illustration of trends in specific geographic areas including housing starts, foreclosures, housing values and building types.

The components of a multipurpose cadastre include;

i. A reference frame consisting of a geodetic network.
ii. A series of current, accurate large scale maps.
iii. A cadastral overlay delineating all cadastral parcels.
iv. A unique identifying number assigned to each parcel that is used as a common index of all land records in information systems.
v. A series of land data files, each including a parcel identifier for the purpose of information retrieval and linking with information in other data files.
vi. A database management system (DBMS). (McLaughlin 1975).

Therefore, this study aimed at analyzing Multi-Purpose Cadastral of staff quarters of The Polytechnic Ibadan, Using Geo-Spatial Techniques.

2.0 Study Area

The Study Area is the Senior Staff Quarters, North Campus, The Polytechnic Ibadan, in Ibadan North Local Government Area of Oyo State. It is geographically located between latitudes 07° 26′ 43.51″N and 07° 26′ 49.12″N and between longitudes 03° 52′ 53.91″E and 03° 53′ 00.15″E.

2.1 Climate

The Polytechnic Ibadan has an equatorial climate with dry and wet season and relatively high humidity. Dry season lasts from November to March while the wet season starts from April and ends in October.

2.2 Topography of the Study Area

The Topography is a gentle rolling low land in the rising to a plateau of about 40meters.

3.0 Material/Methods

3.1 Equipments Used

3.1.1 Hardware

a. Total Station – Kolida KTS 445L
b. Reflector prism
c. Two Handheld GPS
d. Plumb bob
e. Steel tape
f. Field book and writing materials
g. Survey pegs
h. Cutlass
i. Tripod stand
j. 2.16GHz, Windows 8, 64-bit operating system, x64-based processor
k. Hewlett Packard Colour Laserjet 5550dn Printer

3.1.2 Software Used

a. AutoCAD Land Development 2010
b. ArcGIS 10.2 (Data Analysis)
c. Microsoft Word
d. Notepad
e. Microsoft Excel (Data Editing)
f. Windows 8 Operating System

3.2 Test of Instrument

The major instrument used for the acquisition of the geometric data was a Kolida KTS445L Total Station which was tested to ascertain if the instrument is in good order. Both the collimation vertical index error and distance measurement test was carried out on the instrument. Table 1 below shows the collimation test carried out on Total Station. The old and the new values were displayed.

Table 1: Collimation test for the Total Station (Kolida KTS445L)

Collimation	Horizontal reading	Vertical Reading
New	+00^{0} 00’ 10”	+00^{0} 00’ 09”
Old	+00^{0} 00’ 08’’	+00^{0} 00’ 08’’
Difference	+00^{0} 00’ 02’’	+00^{0} 00’01’’

Source: Authors Field Observation

Expected angular accuracy is: 30”√n (where n is the number of station occupied)

n=1. Therefore the angular accuracy is = 30”

From the above test, the result shows that the instrument was in good condition since the angular specification for third order job is 30” and results obtained are less than 30”

3.3 Methods of Data Acquisition

Before the required data were obtained, instrument test and control check were carried out to ascertained condition of the instrument that will be used and control to use for orientation of the study. The coordinates of the control points used for the purpose of orientation of the study were given in table 2 below;

Table 2: Coordinate of Control Points Used

Pillar Number	Easting (m)	Northing (m)
PBN 30309	597825.683	823293.397
PBN 30310	597892.075	823187.013
PBN 30311	597932.451	823134.804

Source: Departmental Archive

3.3.1 Control Check

A control check was carried out on the pre-existing beacons that were used for the purpose of orienting the new survey so as to ascertain their credibility. Angular and linear measurements were made using the Total Station. Table 3.1 to 3.3 shows the analysis of the checks.

Table 3.1: Control Checks (Observed values)

Station	Sight	Face	Horizontal Reading	Angle	Distance (m)
PBN 30307	PBN 30306	L	00^0 00’ 00”		255.491
	PBN 30308	R	138^0 45’ 18”	138^0 45’ 18”	199.368

Source: Authors Field Observation

Table 3.2: Control checks (Computed values)

From Station	Bearing	Distances(m)	Northing(m)	Easting(m)	Station to
			823830.459	597589.853	PBN 30306
PBN 30307	175^0 24’ 47.4”	255.496	823575.781	597610.290	PBN 30307
PBN 30308	143^0 20’ 38.51”	199.371	823415.839	597729.316	PBN 30308

Source: Authors Computation

Table 3.3: Comparison of observed and computed data

STN		Northing	Easting	Heights
Computed data	PBN 30307	823575.781	597610.290	207.597
Observed data	PBN 30307	823575.785	597610.288	207.588
Misclosure		-0.004	0.002	0.009

Source: Authors Computation

From table 3.3, the observed angle from PBN 30307 to PBN 30308 was 138^0 45’18” while the distance is 199.368m and from table 3.4, the computed angle PBN 30307 to PBN 30308 was 138^0 45’ 25.51” while the distance was 199.371m which shows the angular discrepancy of +00^0 00$^{'}$ 7.51” and discrepancy in distance was +0.003m. Therefore, the result affirms that the controls were good enough to be used. Having ascertained the suitability of the total station instrument and the controls checked, data capturing followed immediately.

Table 4: Back Computation

From STN	Bearing	Distance	ΔN	ΔE	N(m)	E(m)	To STN
					381201.772	163028.902	1
1	156^0 10’ 20.14”	107.025	-97.903	44.237	381103.869	163073.139	2
2	244^0 03’ 54.9”	126.229	-55.206	-114.517	381048.663	162958.622	3
3	246^0 22’ 34.8”	98.229	-39.363	-89.997	381009.300	162868.625	4
4	242^0 14’ 24.11”	110. 272	-51.361	-97.580	380957.939	162771.045	5
5	246^0 02’ 44.76”	47.911	-19.452	-43.784	380938.487	162727.261	6
6	258^0 39’ 10.89”	99.197	-19.517	-97.258	380918.970	162630.003	7
7	275^0 22’ 58.7”	136.656	12.82	-136.053	380931.790	162493.950	8
8	13^0 52’ 19.97”	351.453	338.054	96.120	381269.844	162590.070	9
9	14^0 47’ 10.56”	373.420	361.054	95.302	381630.898	162685.372	10
10	135^0 34’ 18.51”	189.039	-134.998	132.330	381495.900	162817.702	PBN 30307
PBN 30307	143^0 32’ 18.39”	199.378	-160.359	118.493	381335.541	162936.195	PBN 30308
PBN 30308	145^0 16’ 35.65”	162.754	-133.769	92.707	381201.772	163028.902	1

3.3.2 Data Acquisition

The geometric or spatial data (X and Y) coordinates of features for the study were acquired through digital land surveying technique using the Kolida KTS445L Total Station and its accessories after all necessary test were carried out on the instrument as well as the control check used for the orientation of the work. The principle of working from whole to part was meticulously observed by setting the Total Station on one of the pre-existing control points (PBN 30307) while the reflector was placed on another of the existing controls (PBN 30306). Having carried out all necessary temporary adjustments, the centering, leveling and focusing, the instrument was made to bisect the reflector target at PBN 30306 for orientation. Subsequent observations which include the coordination of boundary points, fixing of necessary cadastral details and features were then carried out by making observations to the available features in order to determine the x, y coordinates. During the changing of instrument station, the total station and target were moved and positioned interchangeably on the selected stations so as to re-orient the instrument and this process was repeated until the entire field work was completed. The attribute data used for the purpose of this study were obtained by carrying out a social survey of the study area. The residents of the area were interviewed and the chairman of the institution housing committee was also consulted to know the amount of taxes paid by each occupant to the government as an incidence of the housing they enjoy.

3.4 Data Processing

3.4.1 Back / Area Computation

The coordinates of the boundary points were used to determine the latitude, departure, distance and bearing of the boundary line. Table 4 shows the back computation of study.
From the table 4, the area for the study was computed as 21.762 Hectares.

3.4.2 Linear Accuracy

The linear accuracy for the study was computed. Table 5 shows the discrepancy in x, y coordinates which was used to compute for the linear accuracy.

Table 5: Starting and Closing Coordinate for Linear accuracy

Remarks	Eastings (m)	Northings (m)	Station
Starting coordinates	597610.290	823575.781	PBN 30307
Closing coordinates	597610.288	823575.785	PBN 30307
Discrepancy	-0.002	+0.004	

Linear accuracy = $\dfrac{\frac{1}{\sqrt{\Delta E^2 + \Delta N^2)}}}{Total\ Distance}$ (Total distance covered = 2001.573m)

$$= \frac{\frac{1}{\sqrt{(-\mathbf{0.002^2} + (\mathbf{0.004^2})}}}{2001.573}$$

= 1: 426,779.564

= 1: 400,000

The above result obtained showed that the job was carried out perfectly.

3.4.3 Logical Design

Logical design is map of entities, their attributes and relations. The design allows for the arrangement of data into logical structures and is mapped into database management system tables. It is also the stage in which the conceptual design of the entities is transformed into a logical relation. The data relational data structures used for this study were shown in the table 6.1 and 6.2.

Table 6.1: Arc Object and its Attribute

S/No	Attribute Name	Description
1	R_Id	Road Identifier
2	R_Name	Road Name
3	R_Width	Road Width
4	R_Length	Road Length
5	R_Area	Road Area

Table 6.2: Polygon Object and its Attribute

S/No	Attribute Name	Description
1	B_Id	Building Identifier
2	B_Name	Building Name
3	B_Use	Building Use
4	B_Condition	Building Condition
5	B_Type	Building Type
6	B_Area	Building Area

3.4.4 Physical Design

Physical design is the last stage of the design phase and is the stage which the logical structure and data organization for the database were specified. The attributes of each of the table were translated into appropriate built in data types using ArcGIS 10.2 software.

3.5 Database Implementation

Implementing a GIS database design simply refers to the creation of both the necessary attribute relation and the graphical layers as set out by the design specification. Implementation involves the linkage of both the attribute and spatial data together and generating queries that can solve spatial problems. ArcGIS 10.2 software was also used for this purpose.

4.0 Result Analysis

This section involves the spatial analysis of the data generated for this study after being processed with software such as Microsoft Excel, AutoCAD 2007, ArcGIS 10.2. Figure 1-7 are the maps showing various infrastructures for the study. The query to produce the desired results such as cadastral map, the road network, layout of the buildings, economic value of the buildings, building usage, and also the land use and land cover analysis of the study area were presented (see table 7a&b).

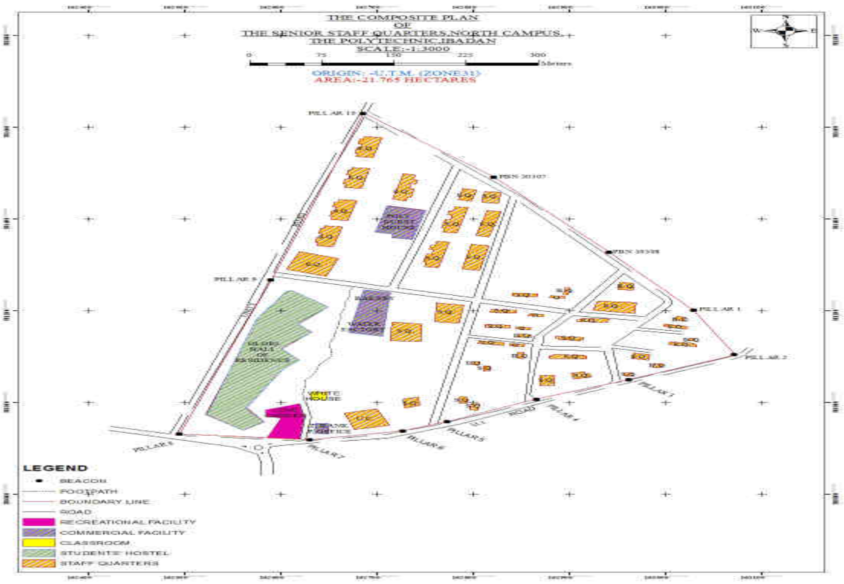


Figure 1: Composite Plan of the Study Area

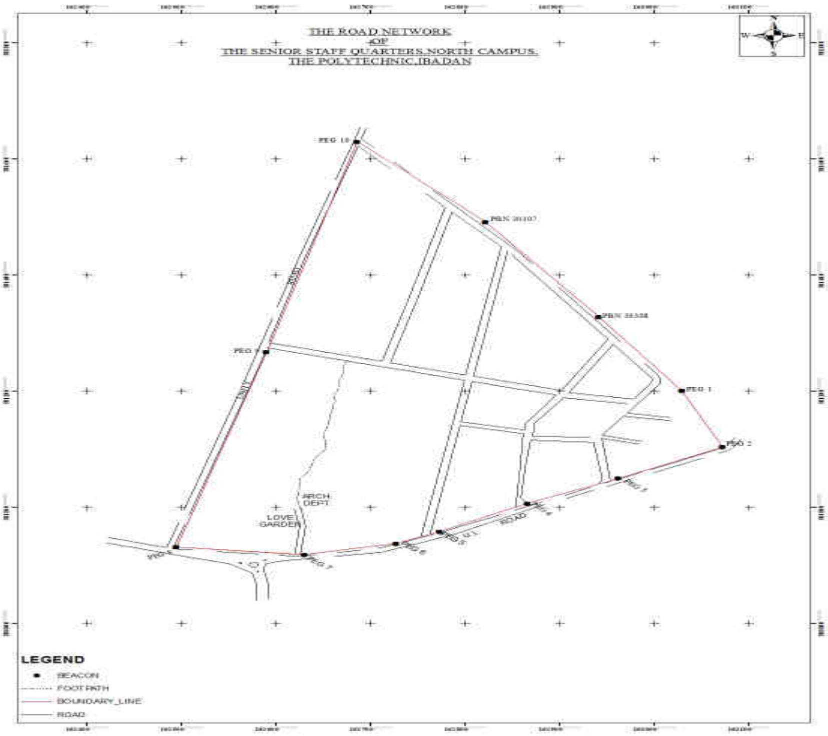


Figure 2: The Road Network of the Study Area

Figure 3: The Layout of Structures Within the Study Area

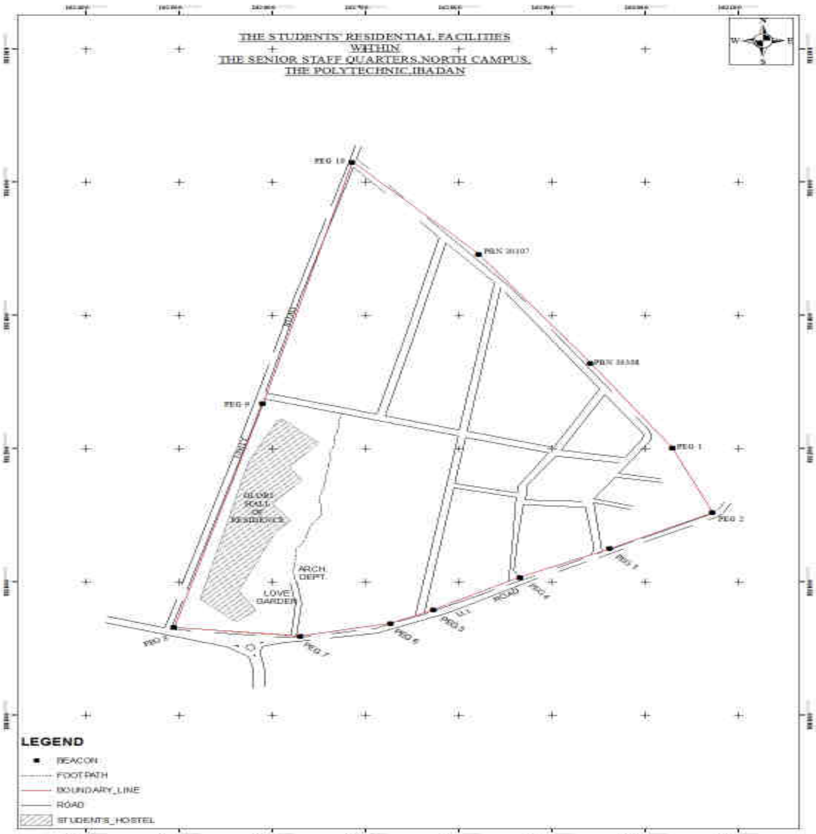


Figure 4: The Students' Residential Facilities Within the Study Area

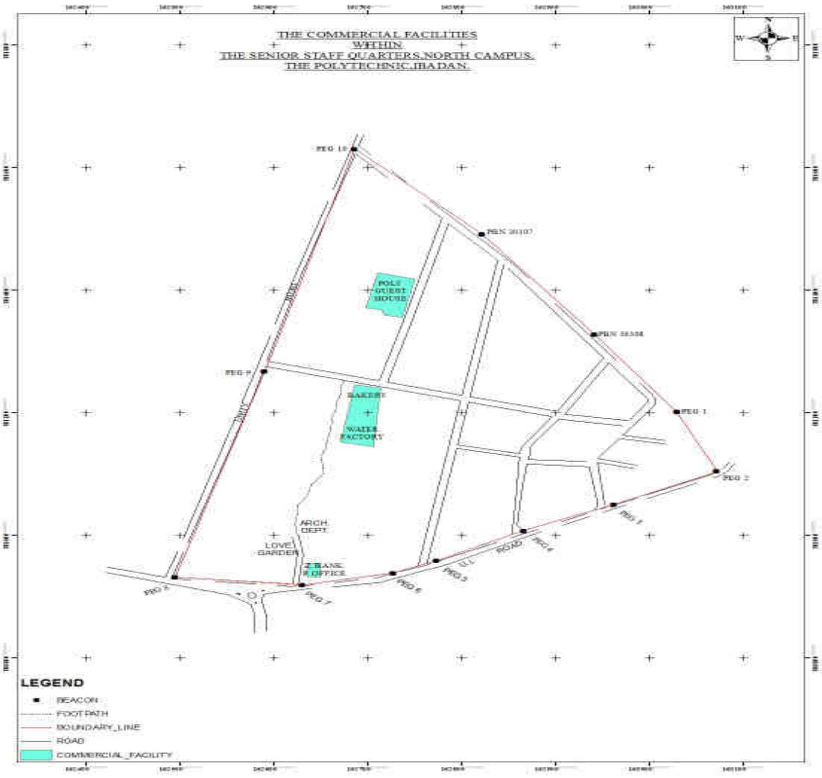


Figure 5: The Commercial Facilities within the Study Area

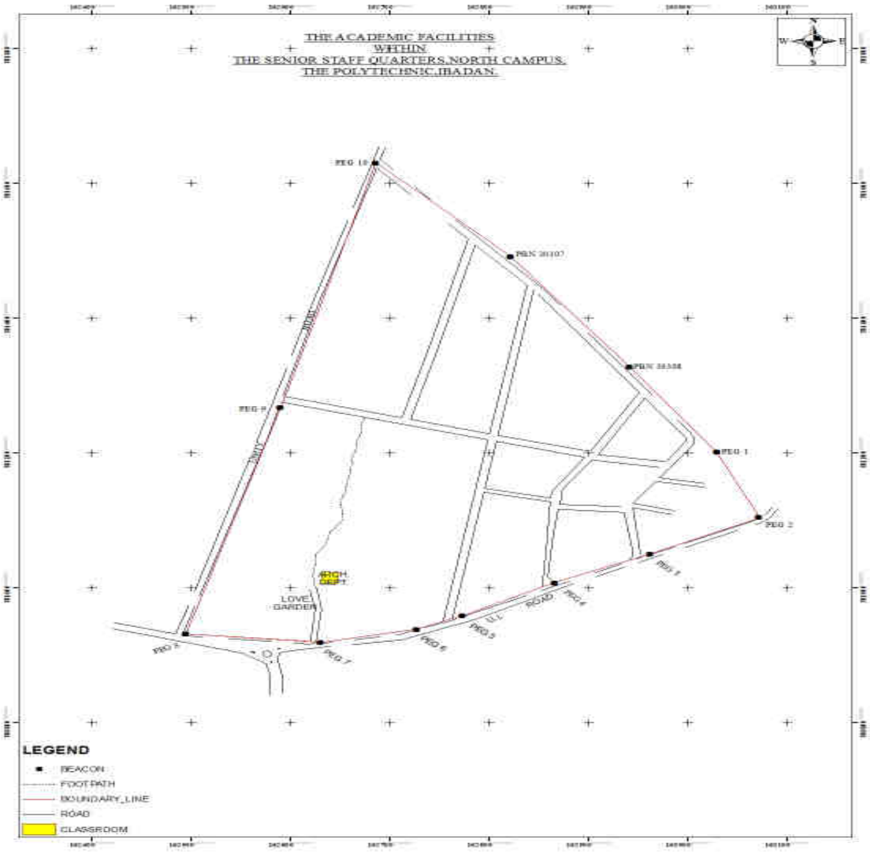


Figure 6: The Academic Facilities within the Study Area

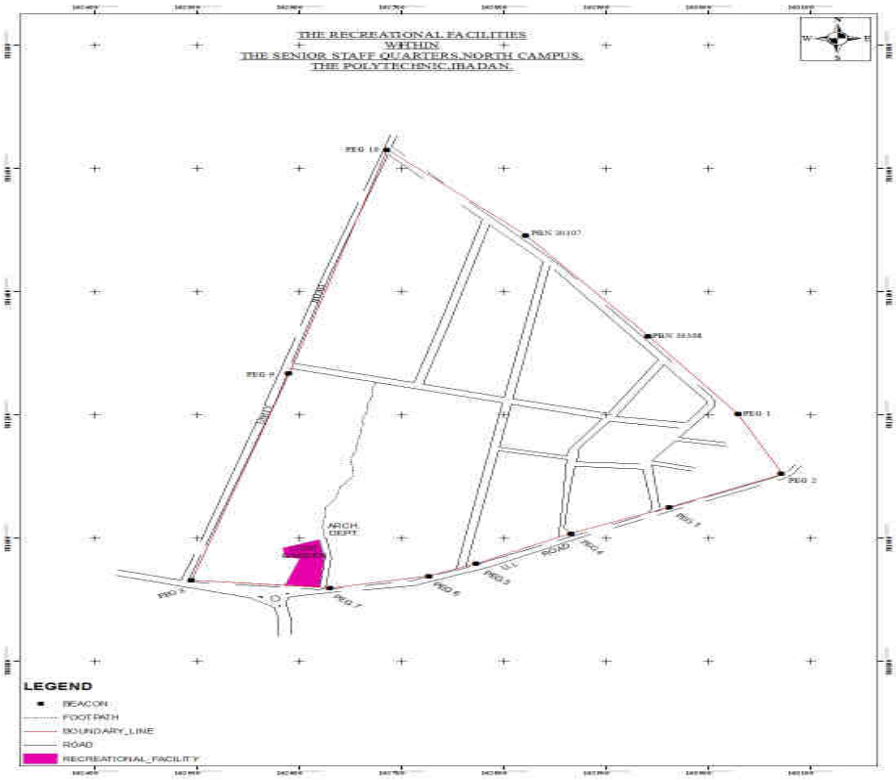


Figure 7: The recreational facilities within the Study Area

4.1 Spatial Analysis

The major advantage of the GIS system is the analytical capabilities of the system as it is the only function that distinguishes the GIS from other systems. The analytical functions used the geo-spatial and non-spatial attributes in the database to answer questions about the real world. The results of the various analyses can be represented on maps, graphs, charts etc. The database was organized into map layers so as to provide rapid access to the data elements required for the GIS analysis. The objective of the analysis is to transform data into useful information that will satisfy the requirements or objectives of decision makers at all levels of the society. Another important use of the analysis is the possibility of predicting future events. Query generation is an in-built program language that operates with the principles of SQL (Structured Query Language). The spatial analysis for this study was performed by queries generation by location and attributes in the ArcGIS environment. The attribute table of buildings in the parcel and road were displayed in table 7(a&b).

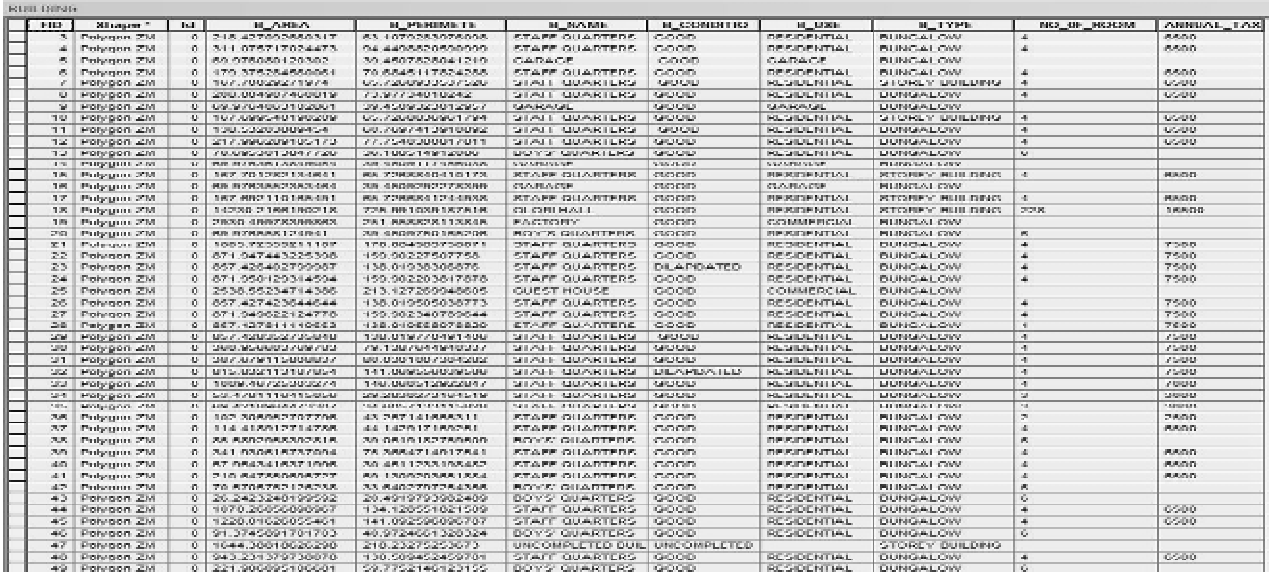


Table 7a: Attribute Table Of Structures Within The Study Area

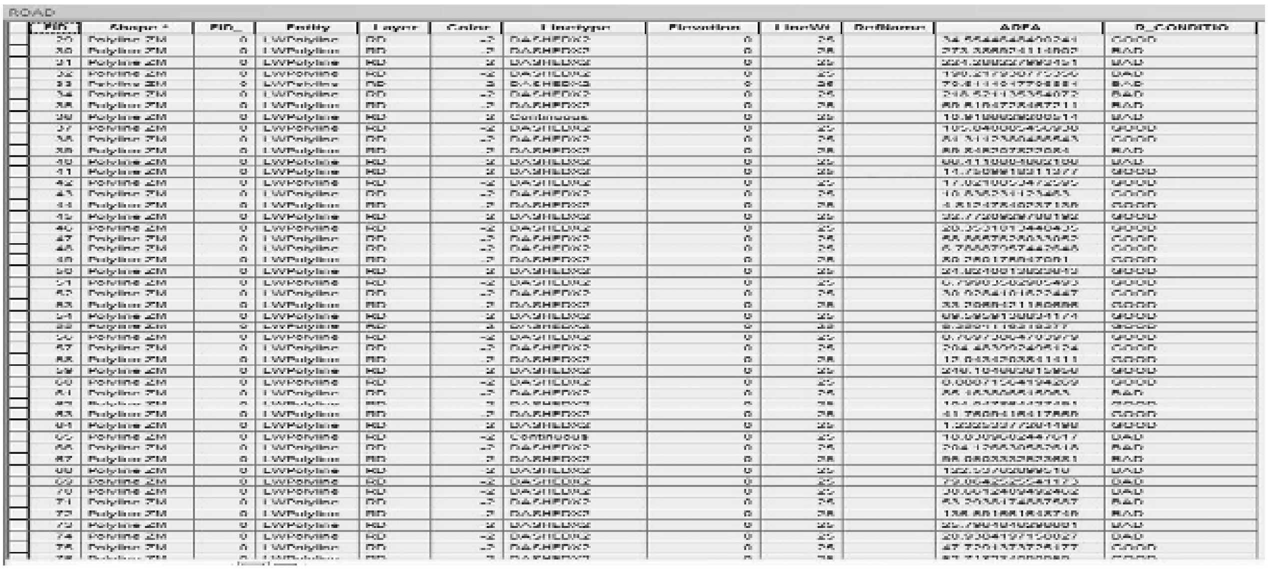
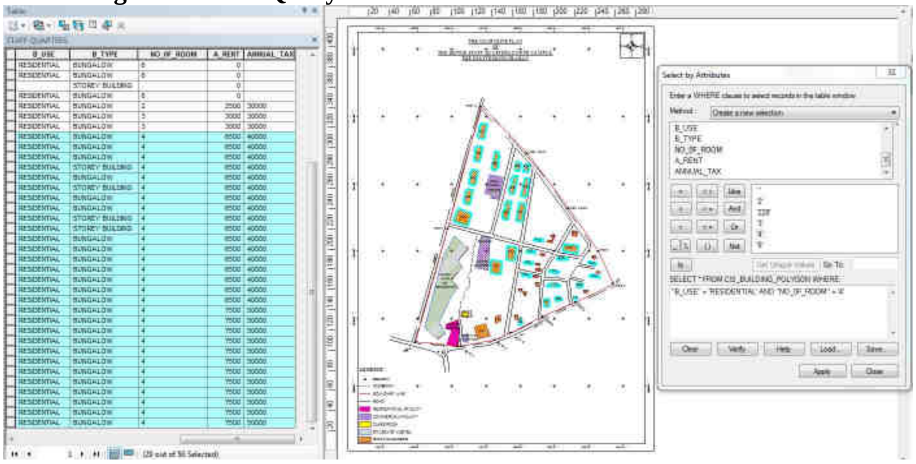


Table 7b: Attribute Table Of Roads Within The Study Area

4.2 Spatial Search and Query

Spatial search is used in GIS to search for particular areas of interest within a neighborhood which must be logically defined. It is used in the processing and manipulation of data to generate needed information while spatial query is the method of retrieving data that are part of GIS database. For this study, single and multiple criterions were used (see Query 1-17).

4.2.1 Single Criterion Query



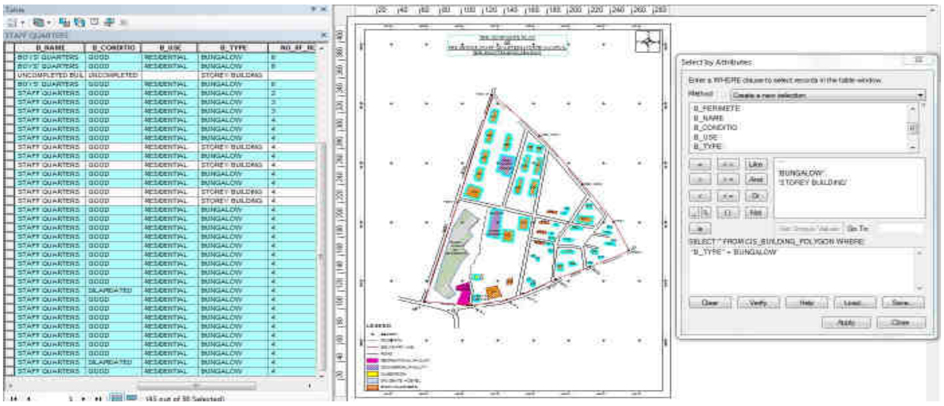
Select by Attributes

Method: Create a new selection

SELECT * FROM CIS_BUILDING_POLYGON WHERE:
"B_USE" = 'RESIDENTIAL' AND "NO_OF_ROOM" = 4

(29 out of 56 Selected)

Query 1: Query to determine the buildings that are used for residential purpose



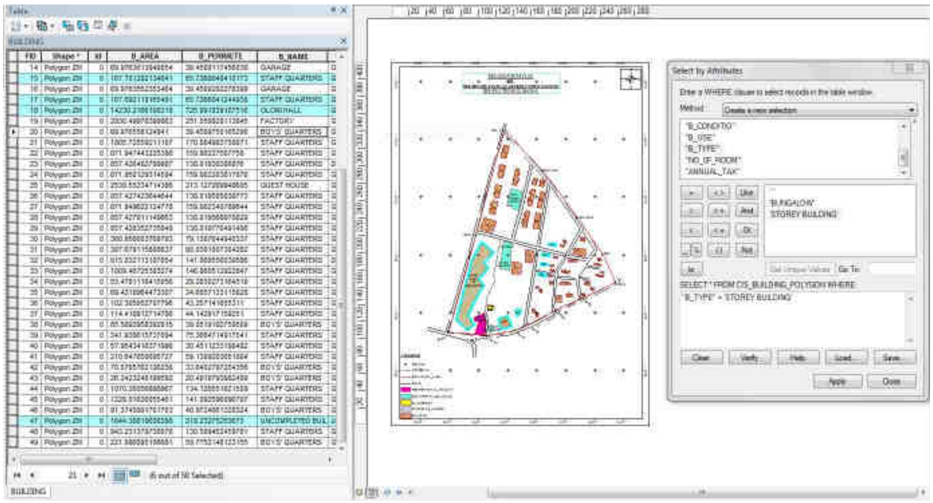
Select by Attributes

Method: Create a new selection

SELECT * FROM CIS_BUILDING_POLYGON WHERE:
"B_TYPE" = 'BUNGALOW'

(45 out of 56 Selected)

Query 2: Query to show bungalow buildings within the study area



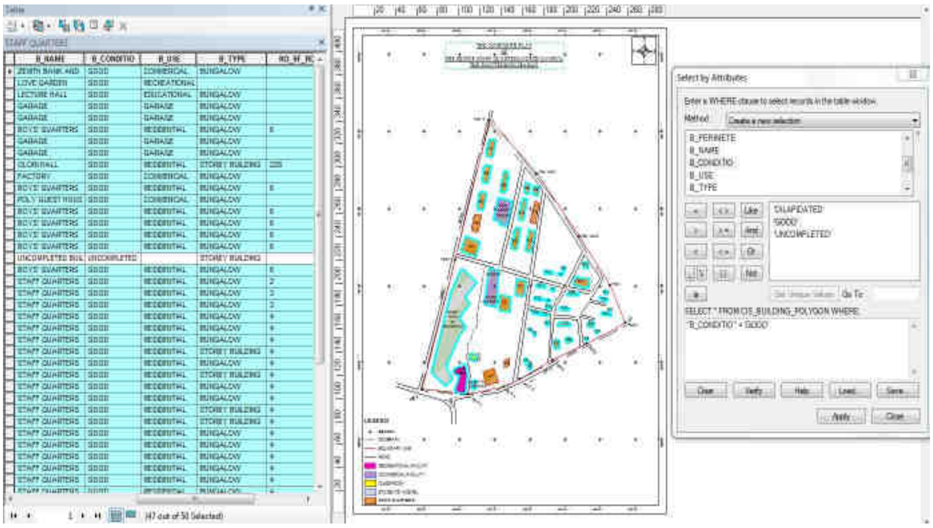
Select by Attributes

Method: Create a new selection

SELECT * FROM CIS_BUILDING_POLYGON WHERE:
"B_TYPE" = 'STOREY BUILDING'

(6 out of 56 Selected)

Query 3: Query to show storey buildings within the study area

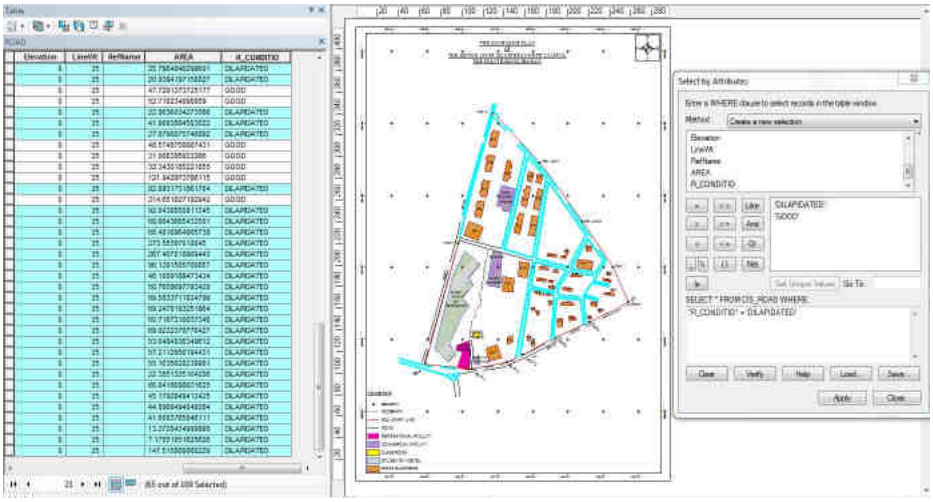


Select by Attributes

```
SELECT * FROM GIS_BUILDING_POLYGON WHERE:
"B_CONDITIO" = 'GOOD'
```

(47 out of 50 Selected)

Query 4: Query to show buildings that are in good conditions

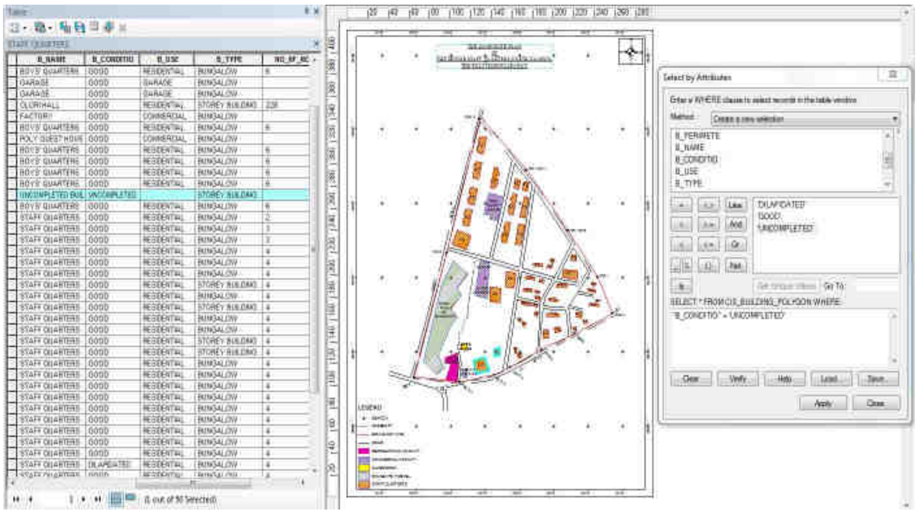


Select by Attributes

```
SELECT * FROM GIS_ROAD WHERE:
"R_CONDITIO" = 'DILAPIDATED'
```

(65 out of 100 Selected)

Query 5: Query to show dilapidated buildings within the study area

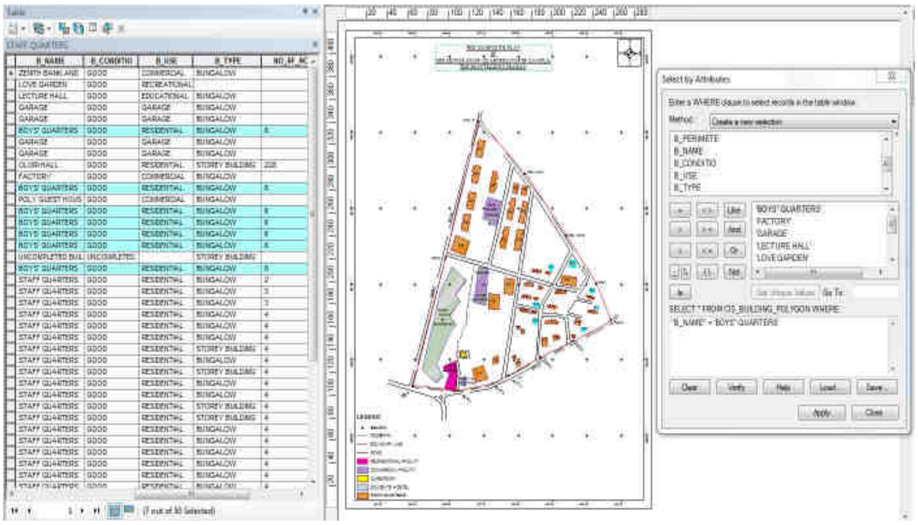


Select by Attributes

```
SELECT * FROM GIS_BUILDING_POLYGON WHERE:
"B_CONDITIO" = 'UNCOMPLETED'
```

(1 out of 50 Selected)

Query 6: Query to show uncompleted buildings within the study area



STAFF QUARTERS

B_NAME	B_CONDITIO	B_USE	B_TYPE	NO_OF_RC
ZENITH BANK ARE	GOOD	COMMERCIAL	BUNGALOW	
LOVE GARDEN	GOOD	RECREATIONAL		
LECTURE HALL	GOOD	EDUCATIONAL	BUNGALOW	
GARAGE	GOOD	GARAGE	BUNGALOW	
GARAGE	GOOD	GARAGE	BUNGALOW	
BOYS' QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	8
GARAGE	GOOD	GARAGE	BUNGALOW	
GARAGE	GOOD	GARAGE	BUNGALOW	
[illegible]	GOOD	RESIDENTIAL	STOREY BUILDING	[illegible]
FACTORY	GOOD	COMMERCIAL	BUNGALOW	
BOYS' QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	8
POLY GUEST HOUS	GOOD	COMMERCIAL	BUNGALOW	
BOYS' QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	8
BOYS' QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	8
BOYS' QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	8
BOYS' QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	8
UNCOMPLETED BUIL	UNCOMPLETED		STOREY BUILDING	
BOYS' QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	8
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	2
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	3
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	3
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	4
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	4
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	4
STAFF QUARTERS	GOOD	RESIDENTIAL	STOREY BUILDING	4
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	4
STAFF QUARTERS	GOOD	RESIDENTIAL	STOREY BUILDING	4
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	4
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	4
STAFF QUARTERS	GOOD	RESIDENTIAL	STOREY BUILDING	4
STAFF QUARTERS	GOOD	RESIDENTIAL	STOREY BUILDING	4
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	4
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	4
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	4
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	4
STAFF QUARTERS	GOOD	RESIDENTIAL	BUNGALOW	4

(7 out of 50 Selected)

Select by Attributes

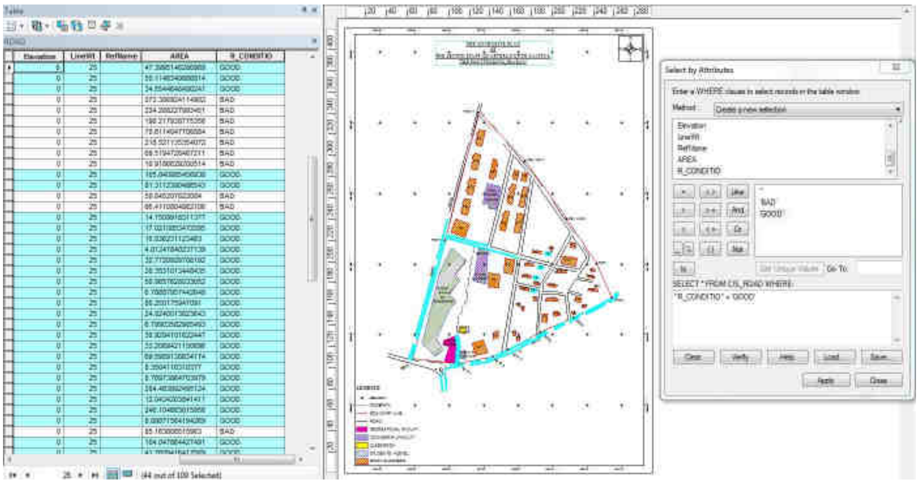
Enter a WHERE clause to select records in the table window

Method: Create a new selection

SELECT * FROM CIS_BUILDING_POLYGON WHERE:

"B_NAME" = 'BOYS' QUARTERS'

Query 7: Query to show the Boy’s Quarters within the study area



ROAD

(44 out of 109 Selected)

Select by Attributes

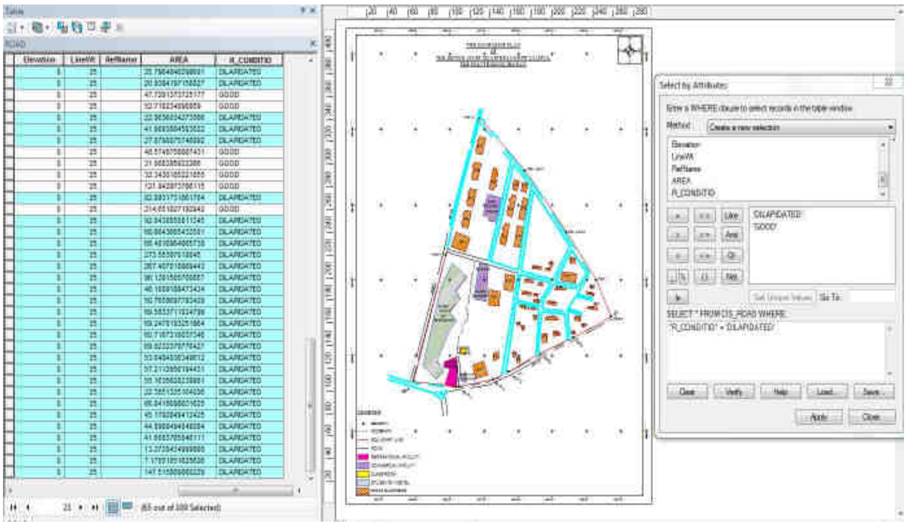
Enter a WHERE clause to select records in the table window

Method: Create a new selection

SELECT * FROM CIS_ROAD WHERE:

"R_CONDITIO" = 'GOOD'

Query 8: Query to show roads that are in good conditions



ROAD

(65 out of 109 Selected)

Select by Attributes

Enter a WHERE clause to select records in the table window

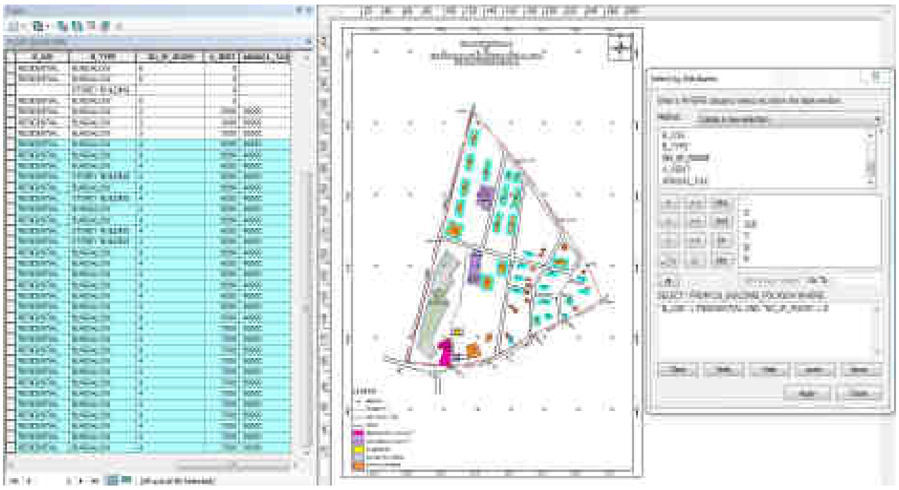
Method: Create a new selection

SELECT * FROM CIS_ROAD WHERE:

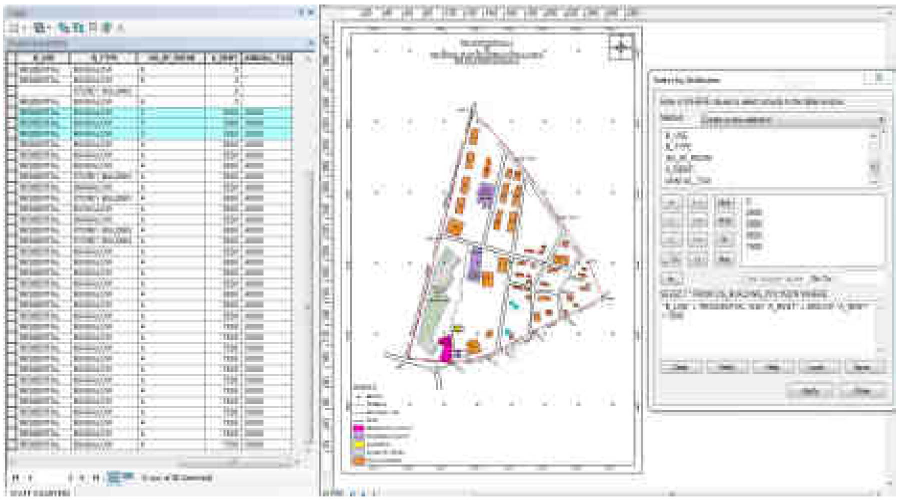
"R_CONDITIO" = 'DILAPIDATED'

Query 9: Query to show roads that are in bad conditions/Dilapidated

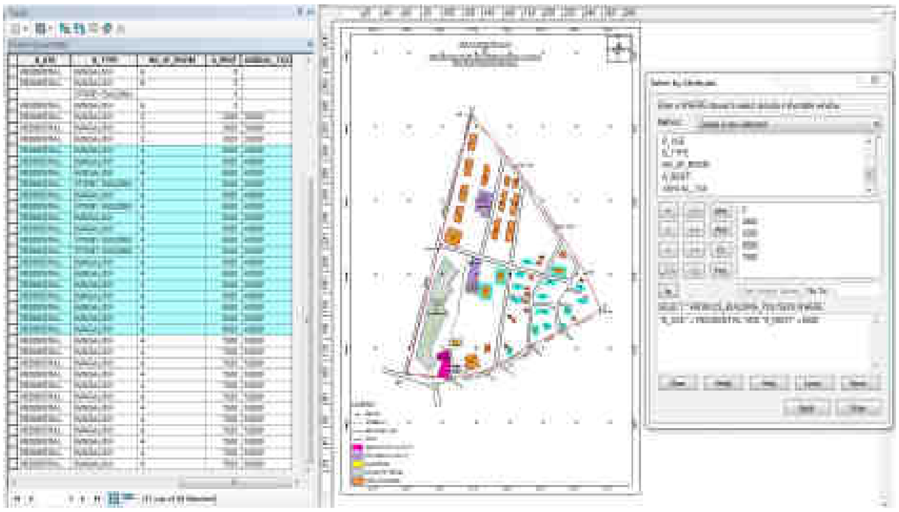
4.2.2 Multiple Criteria Query



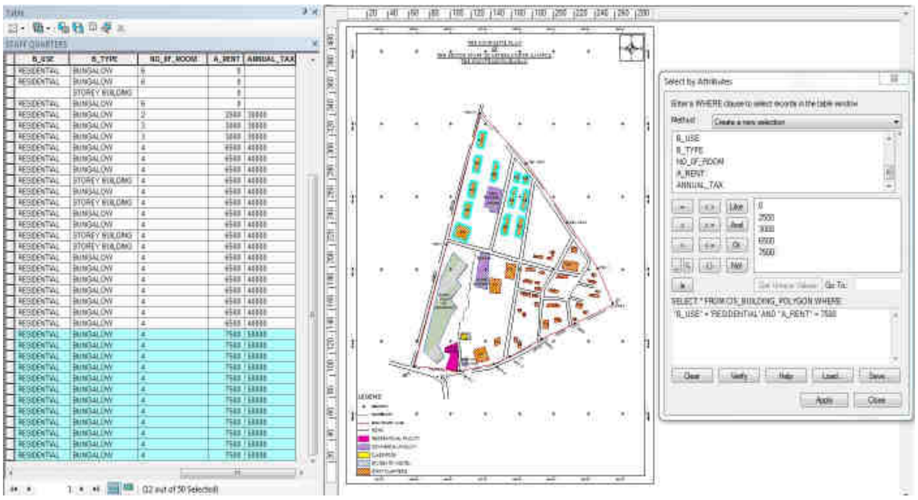
Query 10: Query to show residential structures with four bedrooms



Query 11: Query to show residential structures with an annual rent of between ₦2500 and ₦3000

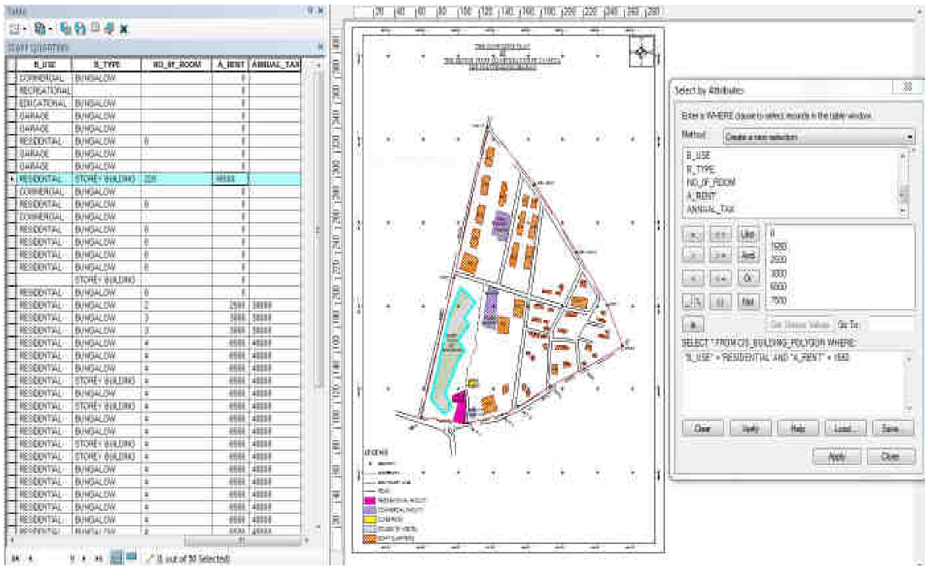


Query 12: Query to show residential structures with an annual rent of ₦6500



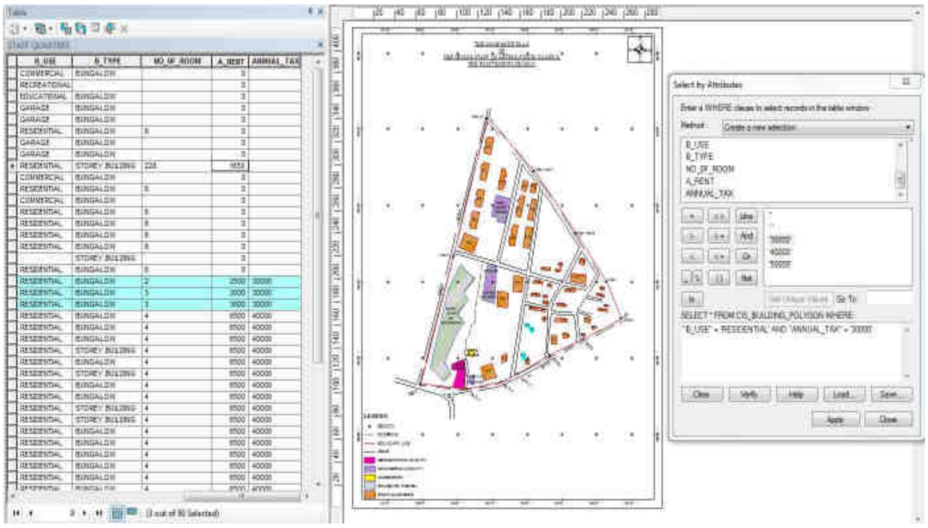
SELECT * FROM GIS_BUILDING_POLYGON WHERE:
"B_USE" = 'RESIDENTIAL' AND "A_RENT" = 7500

Query 13: Query to show residential structures with an annual rent of ₦7500



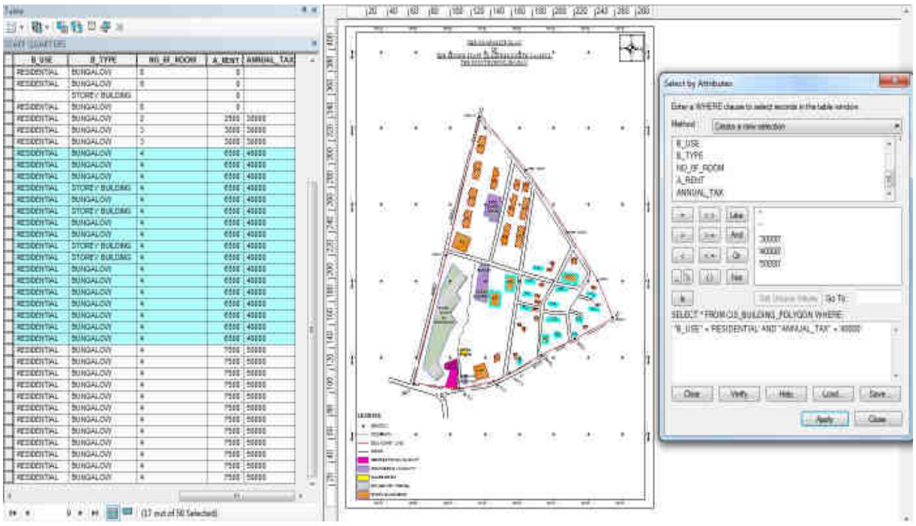
SELECT * FROM GIS_BUILDING_POLYGON WHERE:
"B_USE" = 'RESIDENTIAL' AND "A_RENT" = 1650

Query 14: Query to show residential structures with an annual rent of ₦16500



SELECT * FROM GIS_BUILDING_POLYGON WHERE:
"B_USE" = 'RESIDENTIAL' AND "ANNUAL_TAX" = 30000

Query 15: Query to show residential structures whose occupants pay an annual tax of ₦30000



STAFF QUARTERS

B_USE	B_TYPE	NO_OF_ROOM	A_RENT	ANNUAL_TAX
RESIDENTIAL	BUNGALOW	0	0	
RESIDENTIAL	BUNGALOW	0	0	
	STOREY BUILDING		0	
RESIDENTIAL	BUNGALOW	0	0	
RESIDENTIAL	BUNGALOW	2	2500	30000
RESIDENTIAL	BUNGALOW	3	3000	30000
RESIDENTIAL	BUNGALOW	3	3000	30000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	STOREY BUILDING	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	STOREY BUILDING	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	STOREY BUILDING	4	6500	40000
RESIDENTIAL	STOREY BUILDING	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000

(17 out of 50 Selected)

Select by Attributes

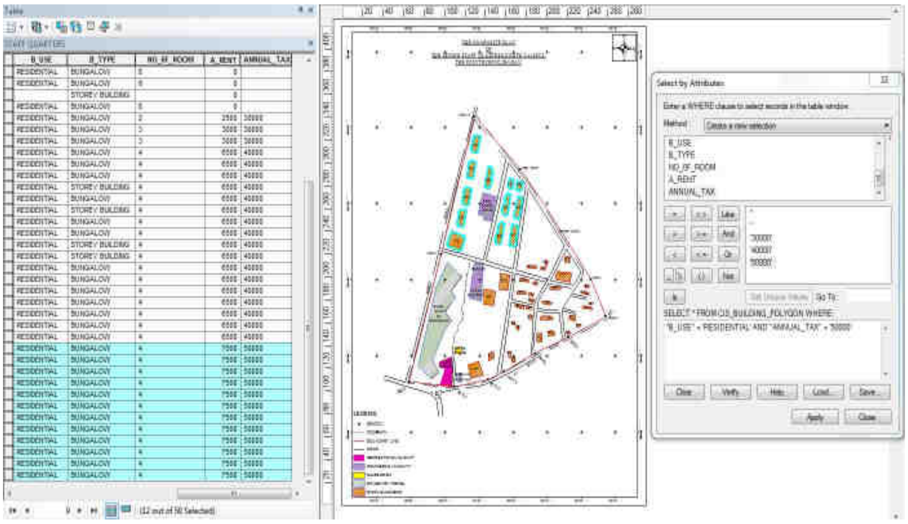
Enter a WHERE clause to select records in the table window

Method: Create a new selection

SELECT * FROM GIS_BUILDING_POLYGON WHERE:

```
"B_USE" = 'RESIDENTIAL' AND "ANNUAL_TAX" = 40000
```

Query 16: Query to show residential structures whose occupants pay an annual tax of ₦40000



STAFF QUARTERS

B_USE	B_TYPE	NO_OF_ROOM	A_RENT	ANNUAL_TAX
RESIDENTIAL	BUNGALOW	0	0	
RESIDENTIAL	BUNGALOW	0	0	
	STOREY BUILDING		0	
RESIDENTIAL	BUNGALOW	0	0	
RESIDENTIAL	BUNGALOW	2	2500	30000
RESIDENTIAL	BUNGALOW	3	3000	30000
RESIDENTIAL	BUNGALOW	3	3000	30000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	STOREY BUILDING	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	STOREY BUILDING	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	STOREY BUILDING	4	6500	40000
RESIDENTIAL	STOREY BUILDING	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	6500	40000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000
RESIDENTIAL	BUNGALOW	4	7500	50000

(12 out of 50 Selected)

Select by Attributes

Enter a WHERE clause to select records in the table window

Method: Create a new selection

SELECT * FROM GIS_BUILDING_POLYGON WHERE:

```
"B_USE" = 'RESIDENTIAL' AND "ANNUAL_TAX" = 50000
```

Query 17: Query to show residential structures whose occupants pay an annual tax of ₦50000

4.3 Discussion of results

From the analysis presented above, it shows that a total of fifty-one (51) structures were within the study area. A total number of forty-one (41) are for residential structures which consists of thirty four (34) staff quarters, seven (7) boys quarters, one (1) recreational centre, one (1) Garden (Love garden), one (1) uncompleted building, one (1) post office, one (1) guest house, one (1) building for bakery and water factory, one (1) student residence (Olori Hall) which comprises of 228 rooms, three (3) commercial centres, one (1) educational facilities. A total number of four (4) dilapidated staff quarters (storey building) which shows that thirty was in good condition. Six (6) boys' quarters were in good condition out of seven (7) which shows that only one was dilapidated. The result also shows that thirteen (13) bungalows in which three (3) rooms pay a rent of #3,000 per month with annual tax rate of #30,000. Other two (2) rooms pay a rent of 2500 per month with annual tax rate of #30,000. A four room's storey building and bungalow pay a rent of #6500 per month with annual tax rate of #40,000. Other four (4) rooms bungalow pay a rent of #7,500 per month with annual tax rate of #50,000. One (1) Students hostel with two hundred and twenty eight (228) rooms pay a rent of #16,500 per section with no tax. With all these analysis, it shows that institution generate a lot of tax per annual on infrastructures.

5.0 Conclusion

The study was centered on the creation of a multipurpose cadastral analysis of senior staff quarters, north campus, The Polytechnic Ibadan and to provide an important guide for the planning and management of developmental projects in the area. The geometric data were acquired through ground survey method using a Kolida KTS445L Total Station while the attribute data were obtained through social survey techniques. Thereafter, the acquired data were extracted from the instrument and edited with Microsoft Excel. The cadastral plan was plotted using AutoCAD 2007, from where it was exported to ArcGIS 10.2 for spatial analysis. In creating the database, both attribute and spatial data used were acquired through land surveying with the use of digital equipment (Total Station) and social surveys respectively. The analysis of result was done using relational database model (tables) and structural query language (SQL) was employed in querying the database. The database created will definitely aid efficient planning, sustainable physical development, easy retrieval and updating of land related information of the study area. The multipurpose cadastral analysis is used for land security; land market, fiscal and judicial purposes.

Recommendations

Database creation for multipurpose cadastral analysis is a very crucial and essential task for sustainable land development projects. It therefore recommended that there is need to put in place an effective multipurpose cadastral analysis that is fully operational in the senior staff quarters, north campus, polytechnic Ibadan, Oyo State , Nigeria. The institution management should make use of the database created for restructuring of some infrastructural facilities rendered to people. This will improve on the procedure of acquiring land titles and scheme up collection of property tax.

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